MARCH 1965 35 CENTS

Popular Science

Monthly

2 MOTOR SCOOTERS You Can Build

HOW TO CASH IN ON YOUR INVENTION

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...irlane, Chevelle,
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...my Stereo Speakers
Projection Screens

Ray Proch

y yellow glaze coating,
d by applying sudden
wide open throttle
. . results in shorting
plug.

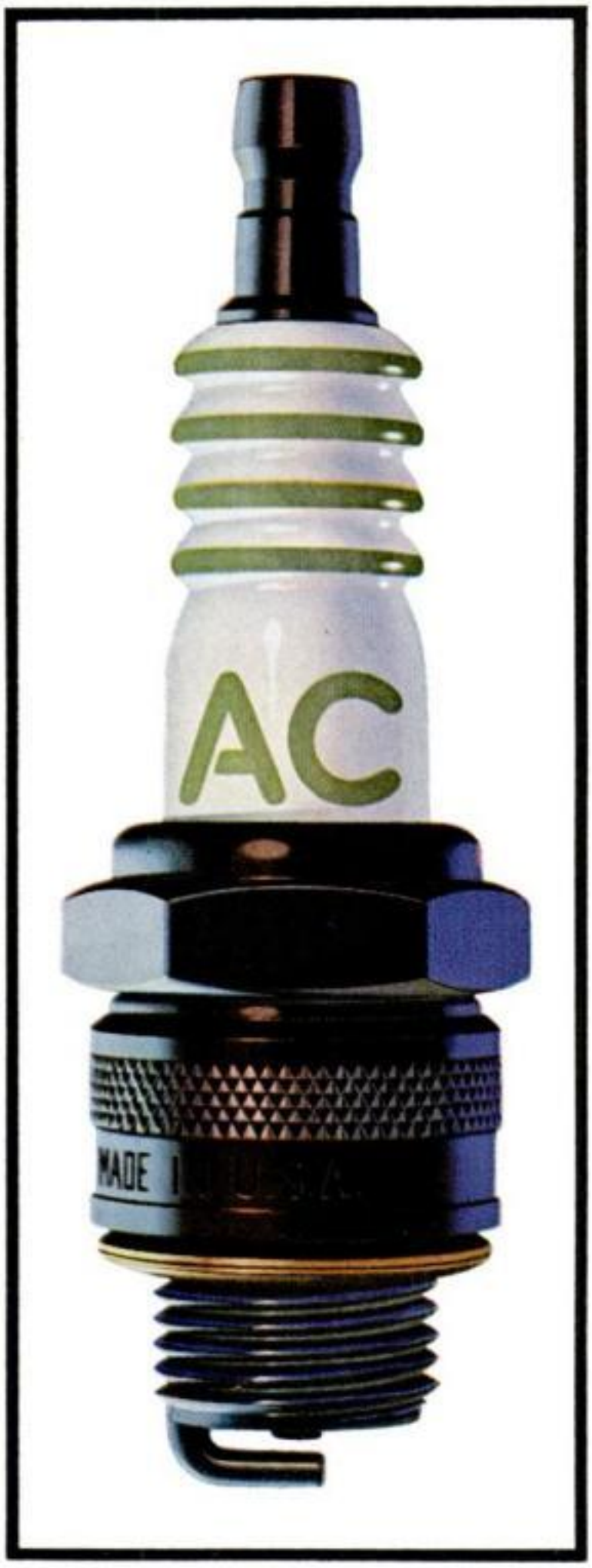
HEAT SHOCK FAILURE—broken or cracked insulator tip, usually caused by over-advanced ignition timing or low grade fuel.

called engine knock—
nage to spark plug . . .
by over-advanced igni-
using low octane fuel.

INSUFFICIENT INSTALLATION TORQUE—severe heat damage caused by failure to install spark plug with sufficient torque . . . results in poor contact and heat transfer between spark plug and engine seat.

burned or blistered
nd badly eroded elec-
tes excessive over-
used by faulty cooling,
ir mixtures or heavy

IMPROPER INSTALLATION—dirty threads often result in spark plug seizing before engine seat gasket is seated, causing poor heat transfer and severe heat damage.



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Tools	182.8	164.4	44.3
Building	144.0	157.6	98.0
Boating	123.7	97.5	85.4
Electronics	113.1	73.0	30.1
Photography	70.2	34.2	45.3
Gardening	39.1	26.7	16.4

Source: The Lloyd H. Hall Co., Editorial Analysis

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Cordially,

Charles S. Thorn

Charles S. Thorn
Vice President

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March 1965

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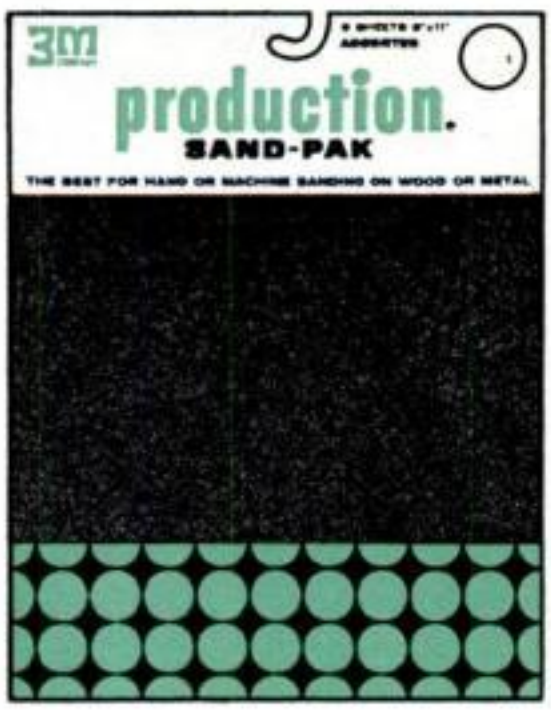
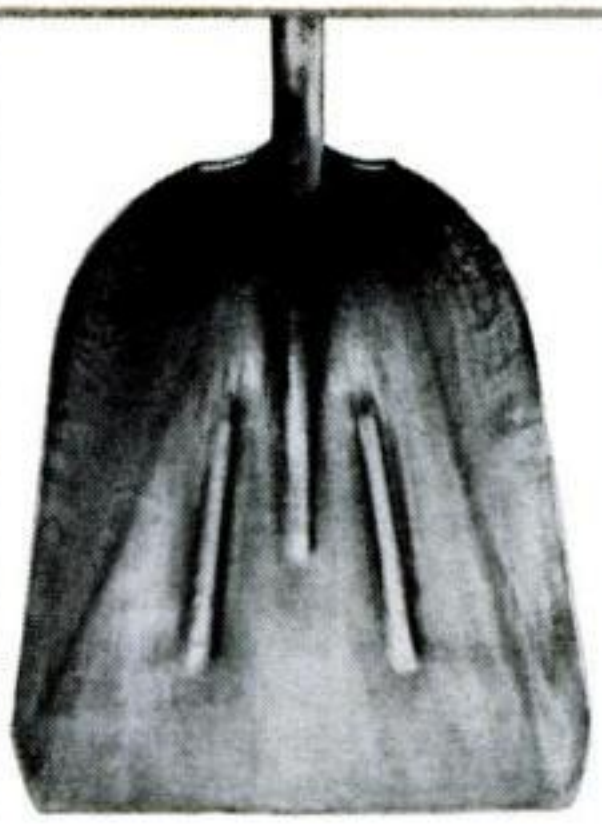


JUST ONE
"PRODUCTION" SAND-PAK



...TOOK RUST
OFF THIS SHOVEL

...REMOVED PAINT
FROM THIS FRAME

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..SCUFFED THIS FINISH
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March 1965

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Your invention: How to protect it, patent it, cash in on it. Page 89.

Who says nobody's doing anything about the weather? Page 80.

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Carburetor gum can choke the life out of your engine

Remove it easily with GUMOUT

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● **How to Buy a Used Car.** You're pretty much at the dealer's mercy—if all you do is kick the tires. PS tells you how to spot a bargain.

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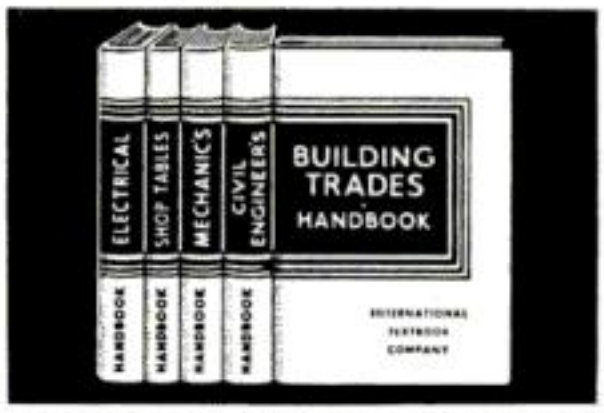

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PS readers talk back

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Shaking the Lemon Tree

The author of "How to Sweeten a Lemon" [Jan.] is certainly overconfident on what help you get going beyond the dealer.

On a crosscountry trip in our new car, we stopped for road service five times and saw dealerships in four states. It finally developed that the trouble was beyond the capability of dealer service. A detailed letter to Detroit was forwarded to the zone office, which forwarded it to my dealer. I wrote the zone office, explained the dealer had conscientiously exhausted his ability to help, and pleaded for their assistance. I got it—they forwarded the appeal to my dealer!

E. R. Gaskill, Altamonte Springs, Fla.

. . . In 1962 I bought a new Rambler for local short-trip use, and before the warranty expired, the clutch "burned out" (as the dealer described it). He ascribed the trouble to *me* and charged for replacement.

Other dealers I talked to (unaware of my troubles) said a clutch is covered by warranty, burned out or not, unless abuse is evident, but I never saw the clutch. The owner of a large service station told me many '62 Ramblers had clutch trouble.

Appeal to the zone manager gained me only double-talk. I just wrote my last letter to Michigan. If I'm turned down again, I just might take your tip and let the public *see* my lemon.

Bernard Brodsky, Springfield, Mass.

. . . . From the start, my '63½ model burned oil, shot out gas from the overflow pipe, pulled left when braked, and the top and dash had to be repainted and the upholstery in the front seat replaced. The refurbishing I got right away. Nothing could ever be found wrong with the brakes. The gas tank was replaced—after six months—but the new one shot out gasoline on warm days even with a ¾-full tank.

After appealing to the district office and Detroit, the dealer rebuilt the motor. After a year, the factory rep looked at the car and said there was nothing wrong with the brakes, and the gas tank never did shoot out gasoline.

I fixed the gas tank myself—by drilling a hole in the gas cap.

C. F. Hedrick Jr., Willow Grove, Pa.

Was You There, Charlie?

In "Wanted: 500,000 Men to Feed Computers" [Jan.], a test question claims: If there are more dogs than there are hairs on any one dog, then at least two dogs have exactly the same number of hairs.

Somebody forgot about Charlie—the imported Mexican hairless. He throws the whole thing off.

Ronald M. Platt, Islington, Ont.

Weird and Wonderful Wankel

If Wankel is building only 5,000 cars with the rotary engine ["Power without Pistons," Jan.], they must have their fingers crossed and hoping. That $3,000 peanut-size car will make its buyers feel left behind when a $2,000 Valiant waves good-bye on acceleration.

J. R. Harman, Grand Rapids.

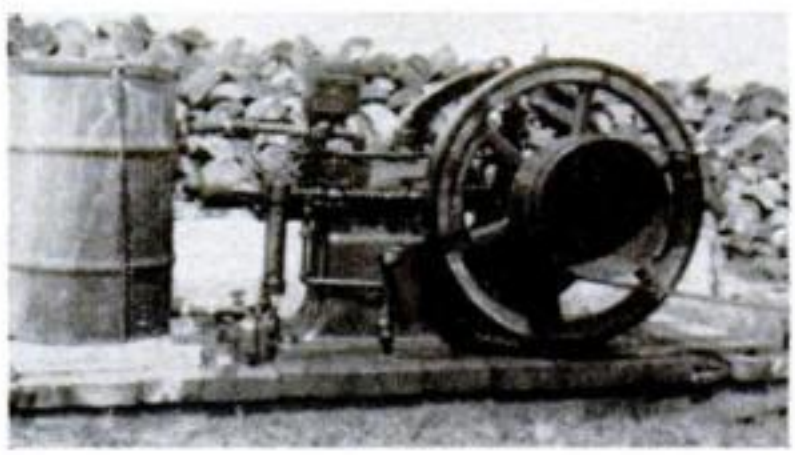
Red Is for Danger

I'd like to inform Francis A. Walsh ["PS Readers Talk Back," Jan.] that red sticks of dynamite do, indeed, exist. The Austin Powder Co., one of the oldest and largest makers of explosives in this country, sells its high explosives in red shells or casings. Particularly around coal mines and quarries, the distinctive red color leaves no doubt of the danger of Austin powder.

Guy E. Waltman Jr., Cleveland Heights.

Antique Still Putt-Putting

Lovers of old gasoline engines might be interested in this Gould Shapley and Muir. Made



in Canada around the time of World War I, this 3½-hp. job with all bronze bearings still works. The original ignition system was poor,

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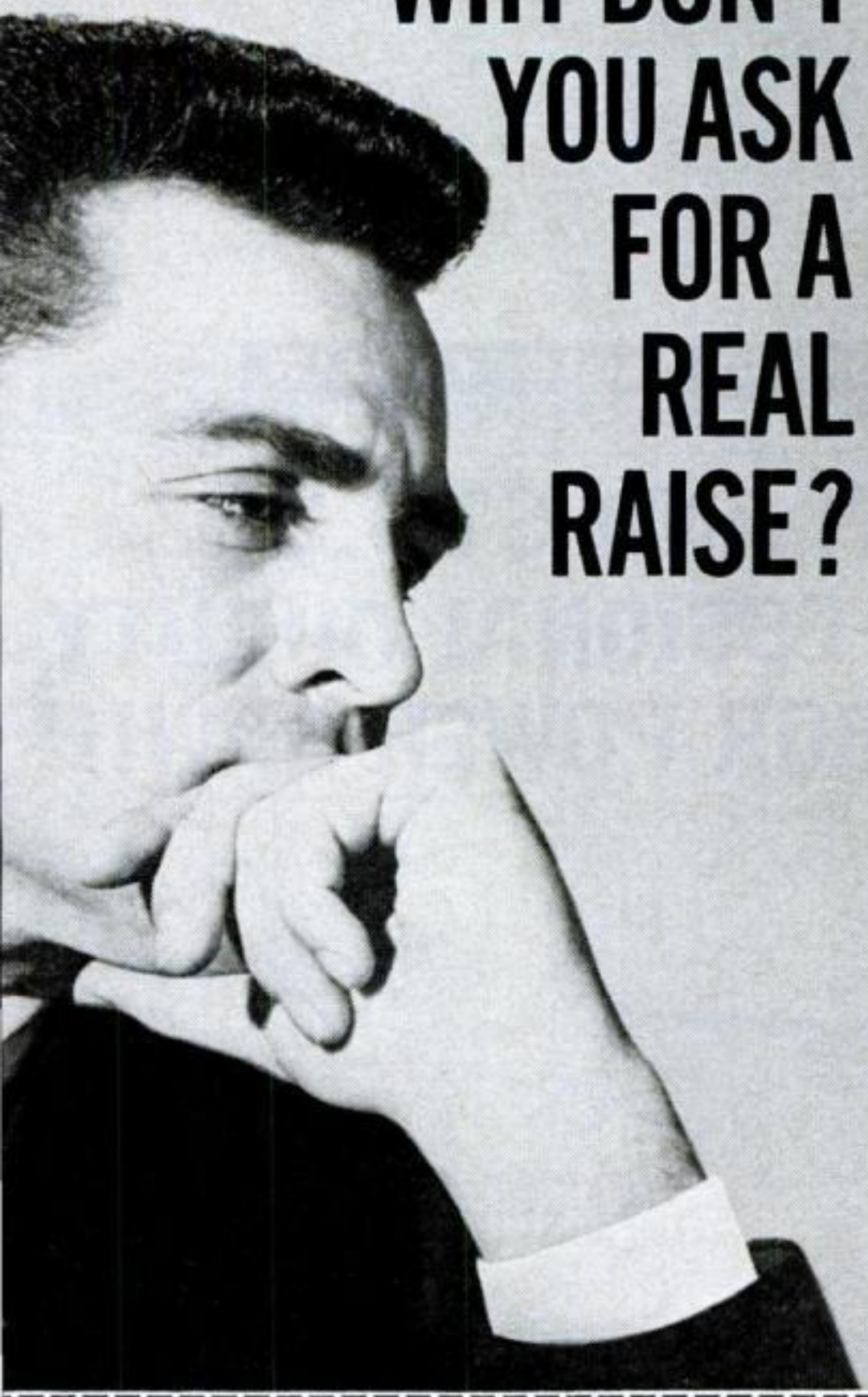

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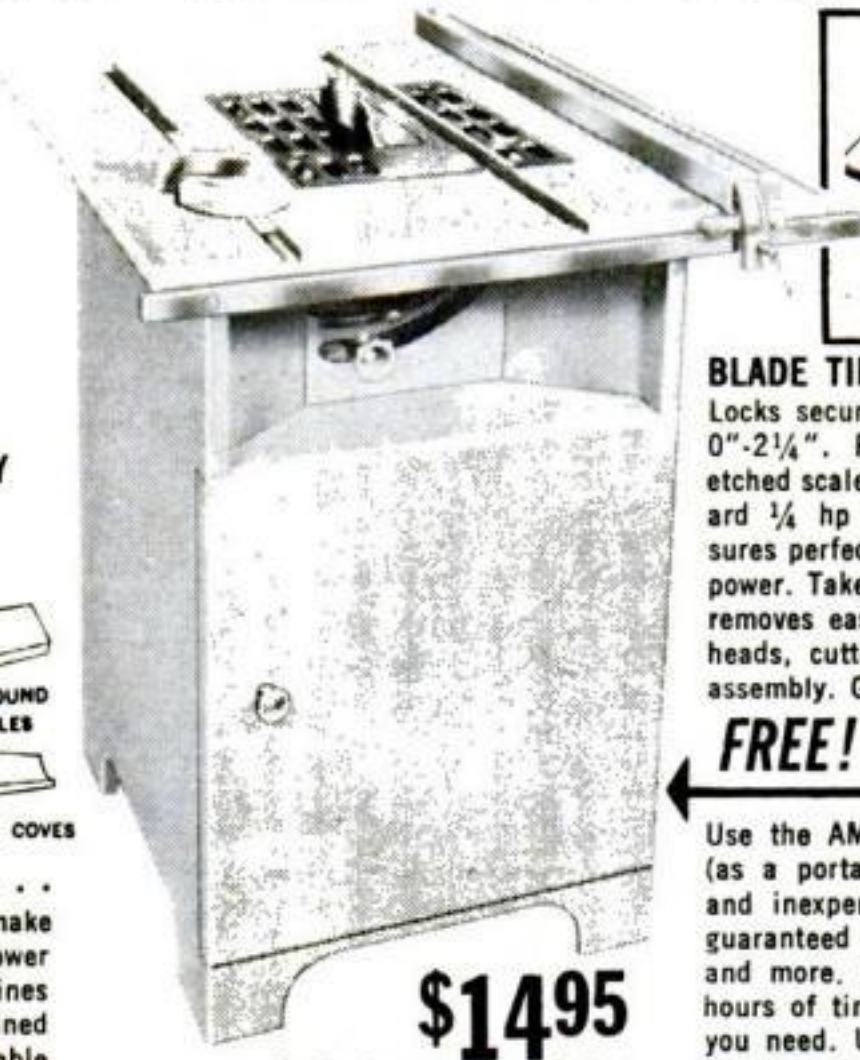

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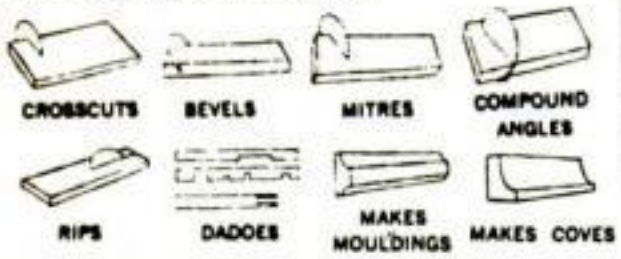


REVOLUTIONARY NEW PATENTS . . . NEW DESIGN are the secrets that make possible this top quality full-scale power tool . . . with speed, accuracy of machines selling for as much as $300. Streamlined design features such as perforated table top reduce weight, material cost, polishing, grinding time. Special patents add efficiency, accuracy, savings. Nothing left out but expensive gingerbread. Parts made, assembled, tested and packed right in our own factory, shipped direct to you.

UNCONDITIONAL 10 YEAR GUARANTEE

$14.95

f.o.b. factory (wt. 25 lbs.)

Includes completely assembled cast iron and steel 8" Tilt Arbor Power Saw with precision ground cast iron table . . . less blade. If desired, **Rip Fence,** for easier work alignment, $3.50 add'l for table top saw as rec'd, or $4.50 for extra long fence for cabinet base.

FREE! CATALOG OF AMERICA'S GREATEST POWER TOOL VALUES!

BLADE TILTS . . . TABLE STAYS LEVEL

Locks securely at any angle to 45°, raises, lowers 0"-2¼". Patented tilt mechanism has accurate etched scale. Patented motor mount takes any standard ¼ hp or larger motor—keeps belt tight, assures perfect alignment at any angle, transmits full power. Takes standard blade (not incl.). Saw insert removes easily for insertion of any standard dadoe heads, cutters, etc. Accurately scaled mitre gauge assembly. Ground spindle.

FREE! CABINET BASE PLANS

Use the AMCO Power Saw the way you receive it (as a portable bench saw) or transform it easily and inexpensively to a floor cabinet unit that is guaranteed to do the work of units costing $280 and more. FREE cabinet base plans . . . 3 or 4 hours of time and a sheet of ¾" plywood are all you need. Use your AMCO Power Saw for cutting. Plans provide 27" x 24" work surface, table height 33", tool storage compartment.

CHOICE OF PHIL RIZZUTO AND 500,000 OTHER HOBBYISTS—"I had no idea how much fun it could be to make things out of wood—nor how easy it could be. I don't know how they do it, but the remarkably low cost of the quality tools by American Machine has taken nothing away from their ability to do a professional job."

SEND COUPON TODAY! YOUR MONEY REFUNDED IN FULL IF NOT COMPLETELY SATISFIED. Return . . . for any reason, express collect within 10 days, for full refund, no questions asked. **AMERICAN MACHINE AND TOOL CO.** DEPT. PS-35, ROYERSFORD, PA.

Urheberrechtlich geschütztes Material

NEW FRENCH GLASSES LET YOU SEE FISH ~~BELOW~~ SURFACE OF WATER!

View without Lunette Glasses

Same view with Lunette Glasses

An amazing new invention hit the world 2 years ago, when the first "Lunette Radar" glasses were brought in from France. For the first time, this amazing invention gave fishermen an easy, inexpensive way to see **below** the water surface . . . to spot fish . . . to let a fisherman see what he's doing instead of fishing "blind."

Invented and introduced in Europe, these sensational glasses sold so fast we **never** caught up with the demand. They were written up in one of New York's great newspapers —but with almost no publicity and very little advertising, we were sold out.

GREATEST NEW FISHING INVENTION

What made these glasses the **most-wanted** fishing aid of the year? First, the obvious fact that fishermen can now—for the first time—see below the surface **as they fish**—with no cumbersome equipment or gadgets.

You just slip these Lunette Radar Glasses on—and water that you can't see into at all with the naked eye becomes clear—so you can see for at least 2 ft. to 12 ft. (or more) below the surface!

See photo illustrations above. These were taken with a **camera lens.** With the human eye, you will see even better! Even with a camera, though, you can see how water reflects glare. Without glasses, you see **only** the surface. Put these Lunette Radar Glasses on and you see below the surface! Now fishermen can see fish before they bite. Now you can bring your line close to the fish and watch the movement of line and lure . . . now you can see your line and lure working . . . now you can take your line in faster because you can see fish take your bait. **NOW YOU CAN FISH "SMARTER"—NOW YOU CAN TAKE MORE FISH—EVERY TIME.** With Lunette Radar Glasses you save precious fishing time. You see into holes—even in swift-running streams. You see through brush-piles, weeds—down into lakes, ponds and salt water.

And you do this with both hands free—with complete comfort and freedom of movement. Now you can bank on more fishing, more pleasure, more enjoyment as you study marine life underwater, learn what goes on beneath the area you fish.

RUSH ORDER—DON'T BE DISAPPOINTED

This year, we have brought in a sizeable supply of Lunette Radar Glasses. We are prepared to fill your order now. But we can't estimate the demand. Orders will be shipped on first-come, first-served basis. So—send coupon now to be sure you get your pair **early**—before the season starts. These famous glasses are **now only $7.95 a pair, plus 50¢ pp. & hdlg. Two pair, only $15 postpaid. You may order either with ear-piece as shown—or clip-on style to wear over other glasses.** We guarantee you will be pleased to own them as thousands of other fishermen have been. If you are not 100% thrilled with them after one fishing trip, return them for an immediate refund.

Rush coupon below to order now for the greatest fishing year you ever had!

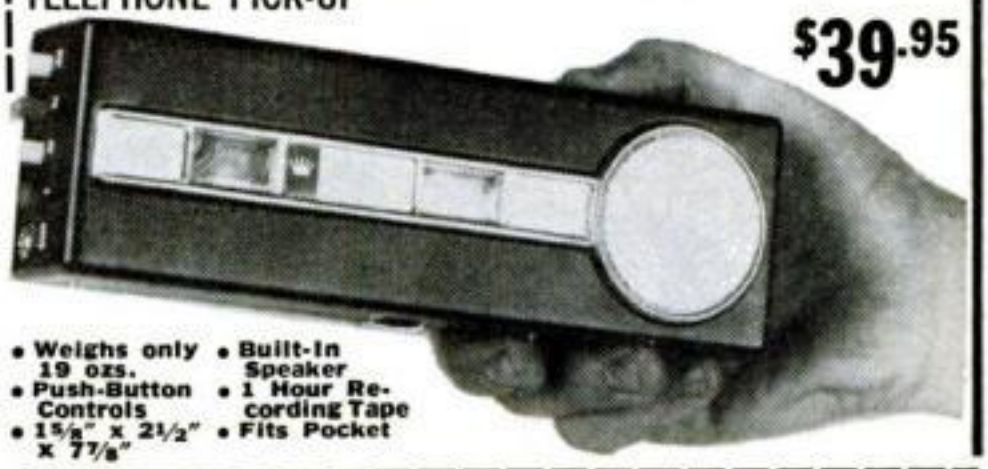
New "Private Eye" CONFIDENTIAL TAPE RECORDER

Fully Transistorized—Records Anything
Ideal for Reports, Memos, Dictation, Etc.

New light-weight tape recorder slips into your pocket or is easily held in hand—records up to an hour on one tape. The mike is a tie-clasp—extremely sensitive—picks up all the impromptu sounds you want. Ideal for executive use in car, plane or train. For doctors or hospitals. Perfect for recording memos, ideas, all conversations. Comes with telephone pick-up. Has built-in speaker, push-button controls for quick in-pocket operation when you want to use it secretly. Fast rewind, stroboscope for synchronizing voice. Operates on 3 inexpensive batteries, which are *included* in set. You also get carrying case, one-hour recording tape, lapel mike & phone pick-up. Satisfaction guaranteed or money back.

FITS IN POCKET—COMES WITH TIE CLASP MIKE AND TELEPHONE PICK-UP

$39.95



- Weighs only 19 ozs.
- Push-Button Controls
- 1⅝" x 2½" x 7⅞"
- Built-In Speaker
- 1 Hour Recording Tape
- Fits Pocket

IMPORTED LOCK-BLADE KNIFE

Flips open instantly and locks automatically to prevent accidental closing. Razor-sharp, tough stainless steel blade for reliable use and hard, long service. Money back if not satisfied. Please state age.

ONLY $1.98 postpaid

- 5½" Overall Length
- Opens Instantly
- Tough & Sharp
- Blade Locks
- Stainless Steel

EMPIRE MDSG. CO. Tuckahoe, N. Y.

MAIL THIS HANDY ORDER COUPON

EMPIRE MDSG. CO., Dept. PS-365
125 Marbledale Rd., Tuckahoe, N. Y.

Please send items listed below (or listed on the attached sheet) on a satisfaction guaranteed basis. I enclose pay't of $.....

_____

_____

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Name .....

Address .....

City ..... **State** .....

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nuts & bolts

Jig saws, abrasive bands, auto parts, skilled mechanics... anything? Just let your fingers do the walking. Action-People do.

so a magneto and spark plug were put in about 20 years ago.

ALFRED BROWN, Matheson, Ont.

Keeping a PS Library?

I have always wished that a portion of your cover could be reserved for just blank space so a reader could note articles of specific interest for later use. I finally worked out my own system. I bought some fair-sized labels with glue on the back and I slap one on the lower right-hand corner of the cover when I get the magazine. As I read, I jot down articles (and their pages) when I find one I know I'll want to relocate in time. It works fine.

FRED DUNCAN, Colorado Springs, Colo.

Lightening the Job

I've discovered a simple method of determining the base of a recording tape. When reels of acetate-base tape are held in front of a light source, light readily passes through; the thinner the tape, the more light passed. With Mylar-base tapes, however, no light will pass, regardless of the tape's thickness.

W. CARNOT VETSCH, New Orleans.

For Two-Fisted Artists?

I admired the three-pronged blivet, and the box ["PS Readers Talk Back," Oct.] to hold it,

so I drew them both. No sweat; I designed a two-handed perule to draw them with.

HENRY O'CONNOR, Winnipeg, Man.

Radiant Entertainment

The tired-child syndrome linked to TV viewing ["Science Newsfront," Jan.] reminded me of other TV warnings. Prof. M. Westergaard of Copenhagen University has said that "X rays emitted from television screens cause great concern among radiologists because [these are] radiations to which large groups of people are submitted for long periods."

There have been several such warnings. The public should not be kept in ignorance of such a hazard.

MATILDA NELSON, Newberry, Mich.

Tip for Weekend Plumbers

Readers who have trouble soldering a leaky copper pipe (a tough job) might like to know of a trick I just learned from a plumber: When hampered by water in the pipe, stuff a piece of bread ahead of the copper joint. This stops the water flow, making a dry pipe that's easy to solder. When the water is turned on again, the bread quickly dissolves.

RICK PLUMB, Owosso, Mich.

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Announcing World-Famous NATIONAL RADIO INSTITUTE'S

Completely New Training-at-Home

for the man who wants to SAVE MONEY and MAKE MONEY
— spare time or full time — cashing in on the demand for men who know how to

SERVICE ELECTRIC APPLIANCES

NRI's 50th Anniversary Brings You This Opportunity of a Lifetime To Become a Master Appliance Technician . . . Save on YOUR OWN Home, Shop or Farm Repairs . . . Make $3 to $5 an Hour Fixing and Servicing Appliances for Your Neighbors!

FOR 50 years, NRI has been successfully training men like you to become top-notch Technicians. Now NRI training is bigger and better than ever – YOU gain bigger and better profits from it!

NRI's *new*, completely revised and *expanded* home-training course offers you EVERYTHING YOU NEED TO KNOW–whether you want to fix your own appliances to *save* money, or *make* money.

Easier Than You Think!

You DON'T need technical experience. You DON'T need higher education. Everything is *explained* in plain English – *shown* in big, detailed, clear pictures. You start from scratch – learn how electricity works – then rapidly advance to installing new outlets, rewiring, fixing and servicing every kind of home, farm and business appliance.

NRI's special new section on modern air conditioning and refrigeration gives you complete know-how in this fast-growing field. Other sections are invaluable for men who work on farms, or in stores or plants. No matter what you're called on to fix, in no time you'll be making repairs like a pro. And – you now get special bonus lessons on 2- and 4-cycle gasoline engines!

Make Extra Money

More than a MILLION appliances and engine-powered tools are sold *each week!* Once you can fix them, you'll "cash in" on this boom. It's a fact: NRI-trained men earn $3.00 to $5.00 an hour *in spare time alone!*

Don't worry how little you may *now* know about repair work. Former student John D. Pettis, who works out of his basement, says: "I had practically no knowledge of any kind of repair work. Now I am busy almost all my spare time and my day off – and have more and more repair work coming in all along."

No matter where you live, everyone owns and *depends on* appliances. And once you know how to service them, the owners depend on YOU!

MAIL COUPON TODAY

Wouldn't you like *right now* to be able to repair your own broken appliances? Wouldn't you like *right now* to have money coming in each week? Let NRI show you how. Free Book and Free Sample Lesson describe the new, expanded, low-cost NRI Course in full . . . show how you can quickly master repairing appliances in your spare time. Mail coupon TODAY (or write direct to): *National Radio Institute, Dept. 601-035, Washington, D.C. 20016.* (No obligation, of course – and no salesman will call on you.)

This FREE BOOK

will open your eyes to a whole world of new opportunities for making money, saving money, through time-tested, low-cost NRI training

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will show how simple and clearly illustrated NRI training is – how it can quickly prepare you to be an *expert* Service Technician in your community!

Earn While You Learn with this Professional APPLIANCE TESTER KIT – *Yours at No Extra Charge!*

FIX ALL THESE – AND MORE!

Travel Irons
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Plugs
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Toasters
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Water Heaters
Centrifugal Pumps
Egg Cookers
Bottle Warmers
Vaporizers
Paint Sprayers
Waffle Irons
Roasters
Deep Fryers
Electric Shavers
Clocks
Food Mixers and Blenders
Tank Vacuum Cleaners
Canister Vacuum Cleaners
Upright Vacuum Cleaners
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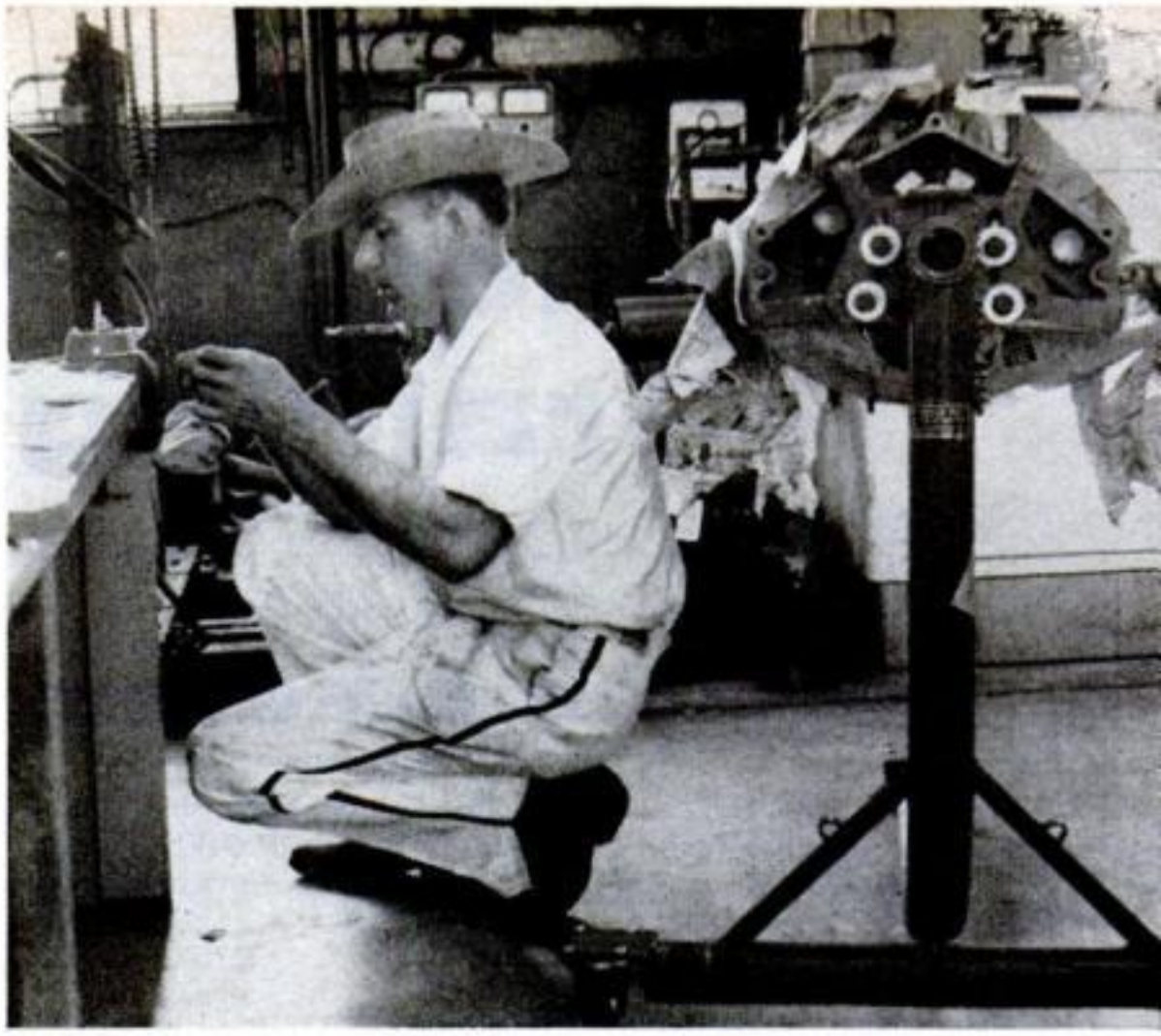
'Say, Smokey–'

A clinic on cars by America's most famous mechanic



EACH month in POPULAR SCIENCE, Smokey Yunick will answer questions on automobiles–family cars, high-performance jobs, hot rods, and racing cars–selected from those sent in by readers. Got a problem? Ask Smokey about it. You'll find the address at the end of the column.

"Recently the temperature gauge read near hot in my '60 Chevy 283-inch car. I put on another 13-pound pressure cap—which the manual recommends—and changed the thermostat. There was no improvement, so I switched to a seven-pound cap. Now the temperature is normal. Will the seven-pound cap do any harm to the engine or the cooling system itself? —L. Lee, NYC.

Not as long as the temperature remains normal and you're not losing any water from your system.

"Our '56 Ford with automatic transmission jerks and shudders on takeoff unless you start up real slow. Our garage says it could be the clutches, but I'd like your opinion, please."—John Danilson, Chevy Chase, Md.

Check the engine mounts and drive train, and the transmission fluid for the correct type and amount. If it still makes like the horrors, you'll have to make the worst check of all—to the garageman for major surgery.

"Recalling that a USAC driver, A. J. Foyt, has won at NASCAR's big track, Daytona, what NASCAR driver do you think would have the best chance at Indianapolis?"—John Branif, Grand Junction, Colo.

I wouldn't pay any odds, but Goldsmith's record is in his favor. If not Goldsmith, then it would be a toss-up, in my book, among Richard Petty, Fred Lorenzen, and Bobby Johns.

"I've had to decarbon my flat-head 90-hp. '63 Rambler three times in 6,000 miles to prevent spark knock. High-test gas and tuneup oil don't help. I have been advised to install double head gaskets to reduce compression. Do you think the trouble might be caused by the crankcase ventilator and not the high compression?"—Bill Beckman, Loretto, Tenn.

I doubt that the crankcase vent is causing your trouble. This car depends on high compression and a high gear ratio to overcome an engine that is really low-powered. You could cut the compression back and reduce carbon cleaning, but your best bet would be to raise the axle ratio, raise your r.p.m.'s, and stop lugging.

"(A) How come Offy engines are not used in super-modifieds? (B) Can truck engines be raced in sprint cars? (C) What advantage is a roll bar, as used in sprints, over the roll cage used in super-modifieds? (D) I hear an open axle is safer than any

CONTINUED

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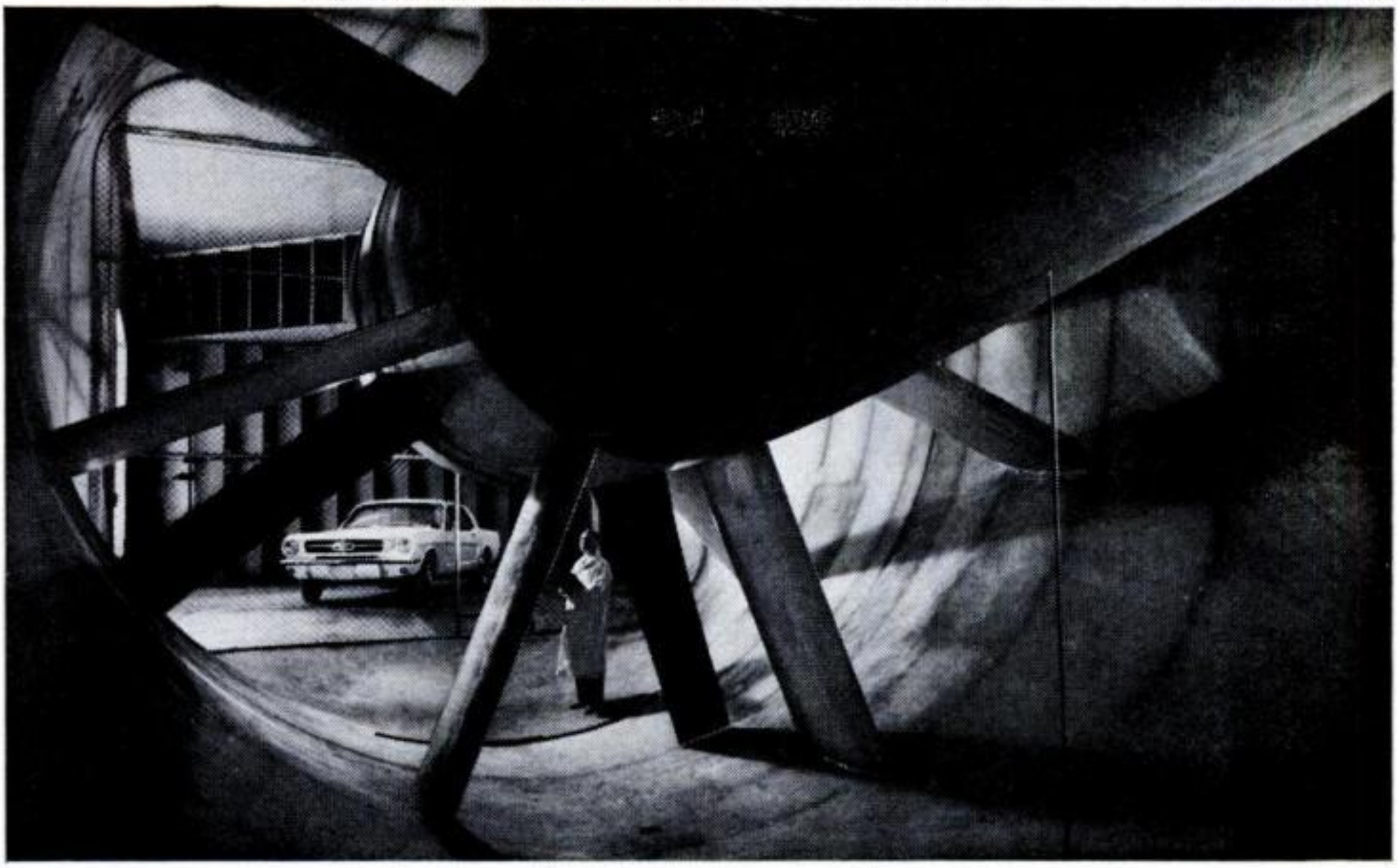
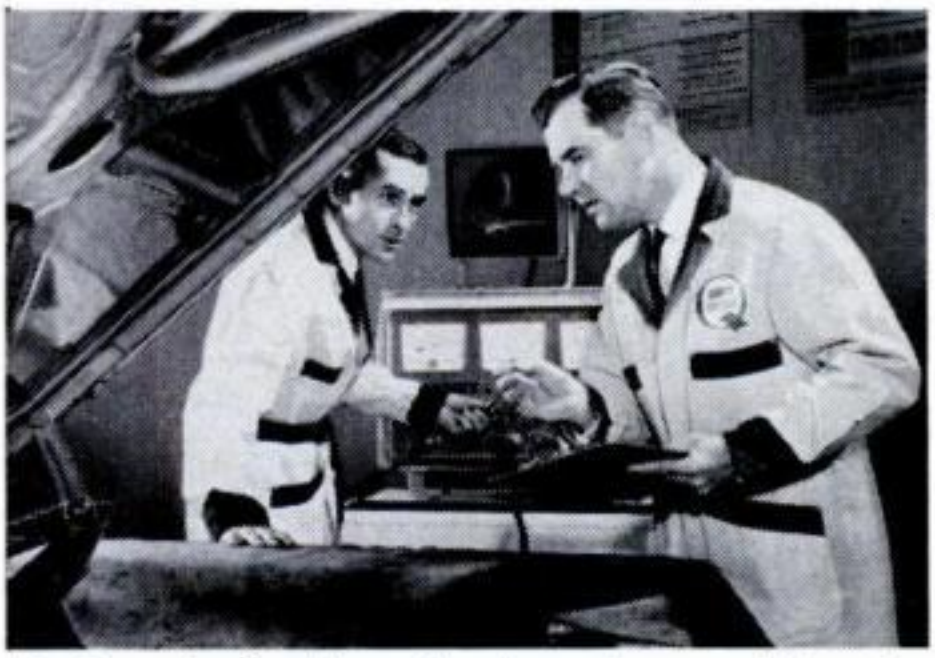
Hurricanes to order are produced in this giant wind tunnel. Ford Motor Company engineers test cars under roughest conditions to help design top quality in every part.



Ford Motor Company builds quality in– Quality Car Care keeps it in

QUALITY CAR CARE



Factory-trained mechanics using special equipment like this oscilloscope engine analyzer and genuine parts make Quality Car Care at Ford and Lincoln-Mercury Dealers best for Ford-built cars.

Your Ford-built car needs so little care, be sure to give it the best. That means Quality Car Care, offered only by Ford and Lincoln-Mercury Dealers. They're the experts!

Only at FORD and LINCOLN-MERCURY DEALERS

Ford MOTOR COMPANY

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NEW from Du Pont

for every car with an automatic transmission

DOES TWO JOBS . . . All transmission fluids contain certain additives which wear out with use. Du Pont "T-Seal" is formulated to replace those worn-out additives and to revitalize the transmission fluid.

IT'S A SEALER . . . Du Pont "T-Seal" stops automatic transmission leaks by chemically reconditioning the hardened, leaking seals. Prevents leaks from occurring by keeping seals soft and pliable. Saves costly transmission overhauls.

IT'S A TUNE-UP . . . Du Pont "T-Seal" renews the efficiency of the transmission fluid itself. Prevents formation of harmful sludge and varnish which could damage precision-built transmission parts. Helps stop slippage and assure quiet, smooth shifting. Prolongs the life of the transmission.

Prevent automatic transmission problems before they start. Get Du Pont "T-Seal" now at service stations and auto supply stores everywhere.

Better Things for Better Living . . . through Chemistry DU PONT

EXCLUSIVE OFFER—Save up to $3.00 on a set of Classic 7 Cars "Matchbox" Series—Models of Yesteryear. See the Du Pont display and money-saving coupon where No. "7" products are sold.

Smokey Yunick continued

other type—how come?"—Tom Holstrom, Topeka, Kan.

You must be going into the business with all those questions. (A) Offies normally are little more than 270 cubic inches, putting out at best 450 hp. Most super-mods run far over those specs. Offies run on alky, and most tracks require gas. But the biggest reason is cost—about $11,000. (B) Sure, so long as you don't exceed displacement rules. (C) No advantage to the roll bar. The cage is far safer. (D) The open axle is not safer than the locked axle in the hands of an expert, who has better control with the locked type. For a driver with limited experience, the open is safer.

"My Corvair Monza with a 102-hp. engine was recently tuned, with new points, plugs, condenser, rotor, wires, spark-plug caps, and high-voltage coil. Now, on a slight pull, I get a continuous ping. When I push harder on the gas pedal, the pinging stops. What's the problem?"—Al Corbett, Lynnwood, Wash.

Check out the initial advance of the distributor, then the automatic-advance system built into it. When the advance is correct, the pinging will stop.

"Would water injection increase economy and acceleration in a '63 Buick Skylark? What does it do—increase r.p.m., hp., torque?—Richard Turner, Augusta, Ga.

You'd gain acceleration, but no long-range economy—for the end result probably would be engine failure. I know of no water-injection system available for a normally aspirated, four-cycle engine. Without all components matched, and properly installed, I'd advise you to give this up as a bad idea.

"The transmission of my 101-hp. Ford with straight stick begins to chatter when I get below 12 m.p.h. This means a continuous downshift from high in city driving. Should I change to automatic, or is there a remedy?"—L. C. Deatrick, Waynesboro, Pa.

If you tuned your car real good, it might stop chattering at 12 and begin at 11 m.p.h. Basically, your trouble is a low-horsepower engine pulling a big car through a high axle ra'io. An automatic transmission

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WE CHALLENGE YOU TO TOP THIS JOB!

Earn To $15 An Hour ★ Work Part-Time Or Full-Time ★ Car Furnished — Expenses Paid ★ No Selling — No Previous Experience Needed ★ Only Average Education Required

NO OTHER CAREER OFFERS YOU A BRIGHTER FUTURE

Consider this fact. In the short time it takes you to read this page 1,100 accidents will take place. Over 440,000 will occur before this day ends. *These accidents must be investigated.* The law demands it. Yet in 4 out of 5 cities, towns and rural communities, no one has been trained for this vital work.

KEEP PRESENT JOB UNTIL READY TO SWITCH

Step into this fast-moving Accident Investigation field. *Already* hundreds of men we have trained are making big money. Joe Miller earned $14,768 his first year. A. J. Allen earned over $2,000 in ten weeks. Robert Meier says "I'm now earning $7.50 to $15.00 an hour in my own business . . . Universal's course is wonderful."

FREE EMPLOYMENT HELP GIVEN

We CAN and WILL show you how to rapidly build your own full-time or part-time business. Or if you wish a big-pay job as Company Claims Investigator, our Placement Service will give you *real* assistance. Hundreds of firms needing men call upon Universal. *We place far more men in this booming field than any other individual, company or school.*

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Write today for complete information. Costs are less than you'd imagine. And even on these low costs you need pay only a portion — less than half — in order to complete your training. We finance the rest for you. You may pay out of actual earnings. And you can keep present job while learning. Send now for free book. No salesman will call. You are not committed in any way.

EARN WHILE YOU LEARN

Let us show you how easy it is to get into this exciting new career in just a matter of weeks. You need NO prior experience or higher education. There's NO investment in expensive equipment. You do NO selling. Furthermore, this fast-growing Accident Investigation field has no seasonal layoffs . . . no time out for strikes . . . no oversupply of men . . . no worry about automation. We ask you to compare these terrific advantages with the job you now have! Cash in on this big demand for trained men NOW. *Write today!*

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6801 Hillcrest, Dallas 5, Texas
Please rush me your FREE BOOK on Big Money In The Booming Accident Investigation Field. I will not be under the slightest obligation — and no salesman will call upon me.

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Ronson introduces the
(Complete with large-

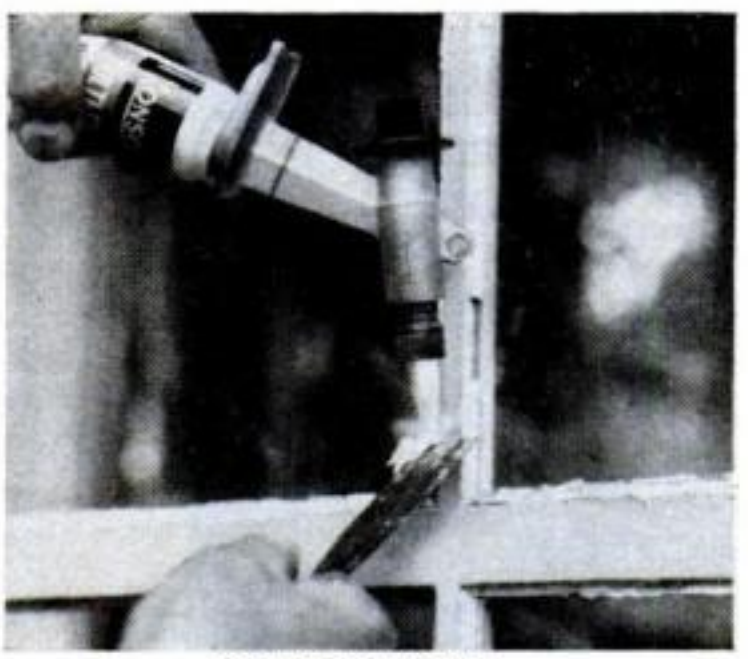
Burns for hours on butane gas. Adjusts from pinpoint to

STARTS LOG FIRES.

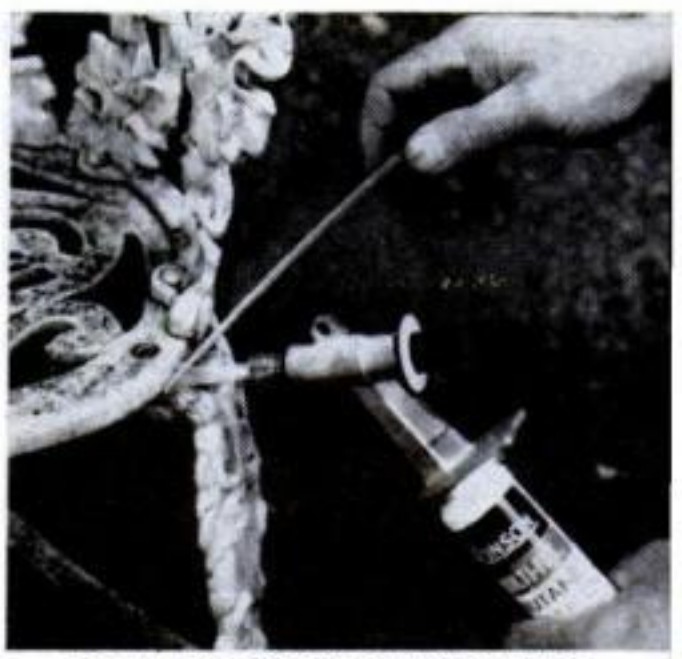
MELTS ICE.

STARTS CHARCOAL FIRES.

REMOVES PAINT.



SOFTENS PUTTY.



FOR HARD-SOLDERING METALS SUCH AS THIS METAL CHAIR.

O.K. You own a hammer, a chisel, a screwdriver—a lot of good, hardworking tools.

So when something at your house needs fixing, you're ready, willing and able to go to work.

Or are you?

Ever try to thaw a frozen water pipe with that hammer?

Or unstick a cracked floor tile with that screwdriver?

Or chip ice off the front steps with that chisel?

Humiliating, isn't it?

(Not having the right tool at the right time can make you feel about as self-sufficient as an old-maid schoolteacher fixing her first flat tire.)

But now Ronson has a new torch that can do all those things. And more.

You don't have to be a handyman to put it to work. It starts charcoal and log fires quickly. It burns leaves and caterpillar nests. You can even use it to put a nice brown meringue on Baked Alaska!

It weighs less than 13 ounces. Much smaller than other leading torches, it takes very little storage space. It's as compact and easy to handle as a flashlight.

A blast from this torch can spot-kill a weed faster than you can yell "Crabgrass!"

A broken wire fence needs mending?

This torch can do a perfect soft-solder job in less than a minute.

It can hard-solder a ½" copper tube to a brass elbow in just a few minutes.

It can help remove old paint.

Soften old putty.

Fix a kid's toy.

Help refinish furniture.

Sweat copper tubing.

(Whew!)

Loosen rusted pipe fittings and connectors. (Just try to get in and around pipes and fittings with a larger torch.)

Free frozen nuts and bolts.

And even stand up like a laboratory burner.

(This comes in handy when you need both hands free.)

How did Ronson put this new torch together?

We used butane gas, and the

RONSON CORP., WOODBRIDGE, N.J., U.S.A. ALSO AVAILABLE IN CANADA. SEE THE RONSON EXHIBIT AT THE WORLD'S FAIR. *SUGGESTED RETAIL PRICE.

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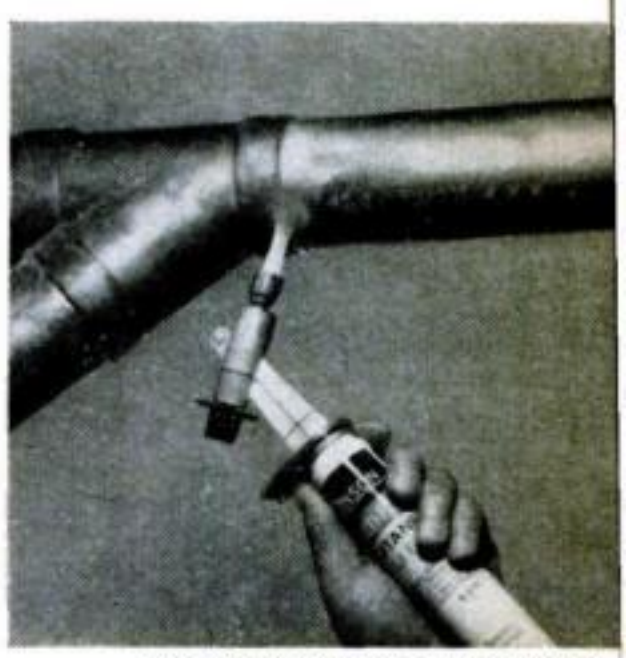
Varaflame Torch .$4.95.*

size butane Multi-Fill.)

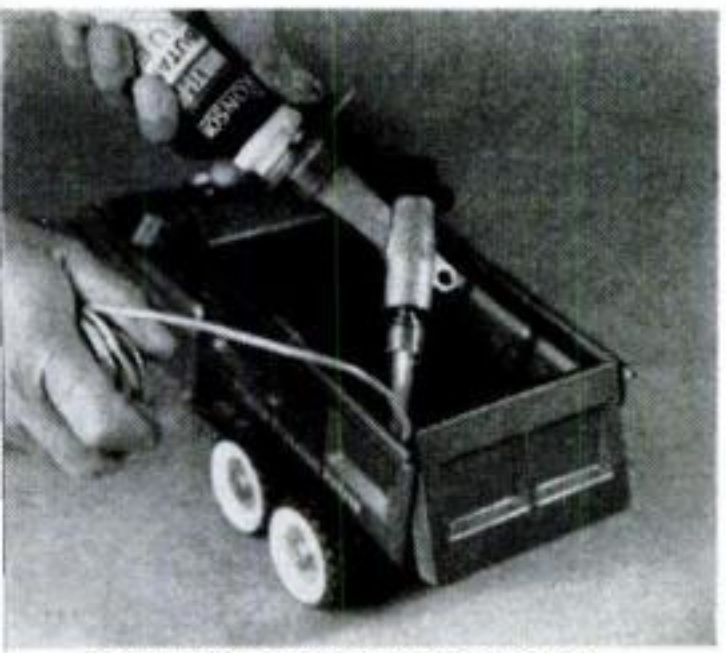
blow torch flame. Lightweight. Compact. Easiest to handle

BURNS OUT WEEDS
AND CATERPILLAR TENTS.

FOR LAYING OR PICKING UP
ASPHALT FLOOR TILES.



SWEATS AND THAWS PIPES.



SOFT-SOLDERS BROKEN TOYS.

FOR BENDING GLASS TUBING AND
OTHER LABORATORY USES.

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Anywhere hardware is sold. The price, complete with large-size, 76 gram Ronson butane Multi-Fill injector, just $4.95.*

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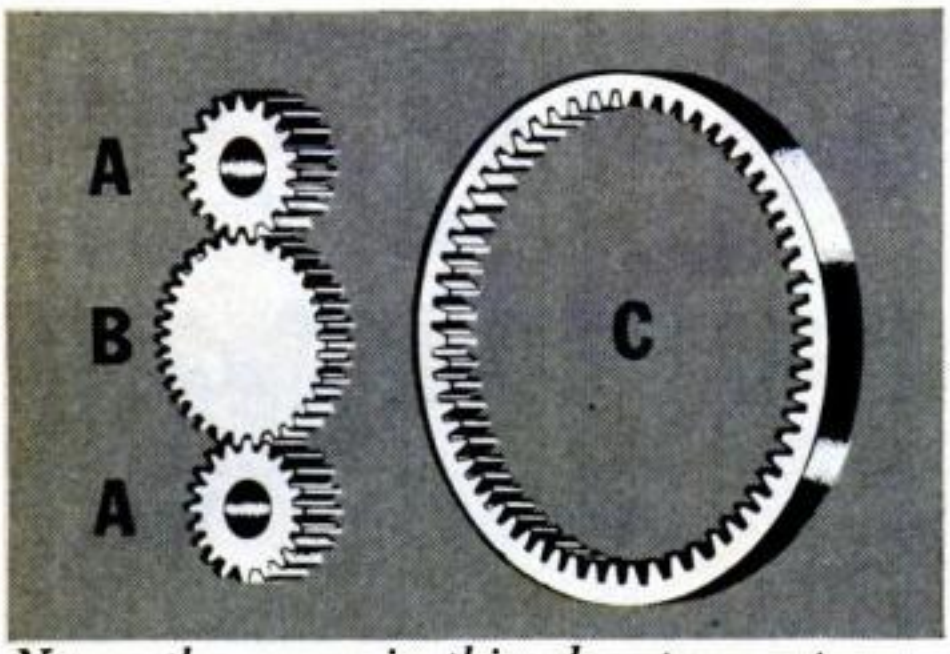

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Smokey Yunick continued

would downshift for you. With a stick, you have no alternative to downshifting.

"I can't get a compass to work in my '57 Volkswagen. Is there a remedy?—S. Rosenzweig, Brooklyn, N. Y.

Be sure your compass is a good one, and then mount it above the windshield, not on it or below it.

"On tires, just what does the first figure—"7.50," for example—stand for?"—Max Ray, Norco, La.

That number means the tire width in inches at its widest part—not at the rim—when it is mounted on the rim recommended by the manufacturer for that size tire. The other number you see on a tire (the "14" in 7.50-by-14, say) is the wheel diameter.

"The manual for my '64 Mercury Montclair says I can go 36,000 miles between greasings. Now, with the odometer at 18,000, my gas-station man says to put on grease fittings or risk damage. Whom do I believe?"—Martin King, Fair Lawn, N. J.

Whether you need fittings now depends on the conditions you have been driving under. Not knowing these, I'd say you'd be safest listening to a reputable local serviceman.

"The Turboglide transmission on my '60 Bel Air recently developed a moderate leak, but not from bad seals. Because the parking pawl no longer engages, I believe there's a crack in the housing. The local Chevy service department says Turboglides aren't repairable, and that this one would have to be replaced with a new Powerglide, costing better than $300. Is this true?"—John E. Engle, Huntsville, Ala.

No. Parts and the know-how are available to repair a Turboglide. But the job would be expensive—in the long run it probably would pay to replace with Powerglide. It is a much better and more trouble-free transmission.

• •

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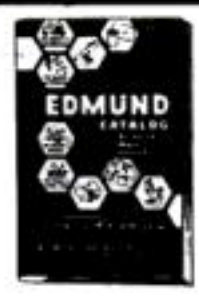

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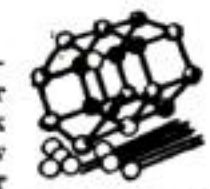

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Science Newsfront

LATEST DEVELOPMENTS IN SCIENCE, BY **WALLACE CLOUD**, PS SCIENCE EDITOR MARCH, 1965

Space Station Gets Go-Ahead

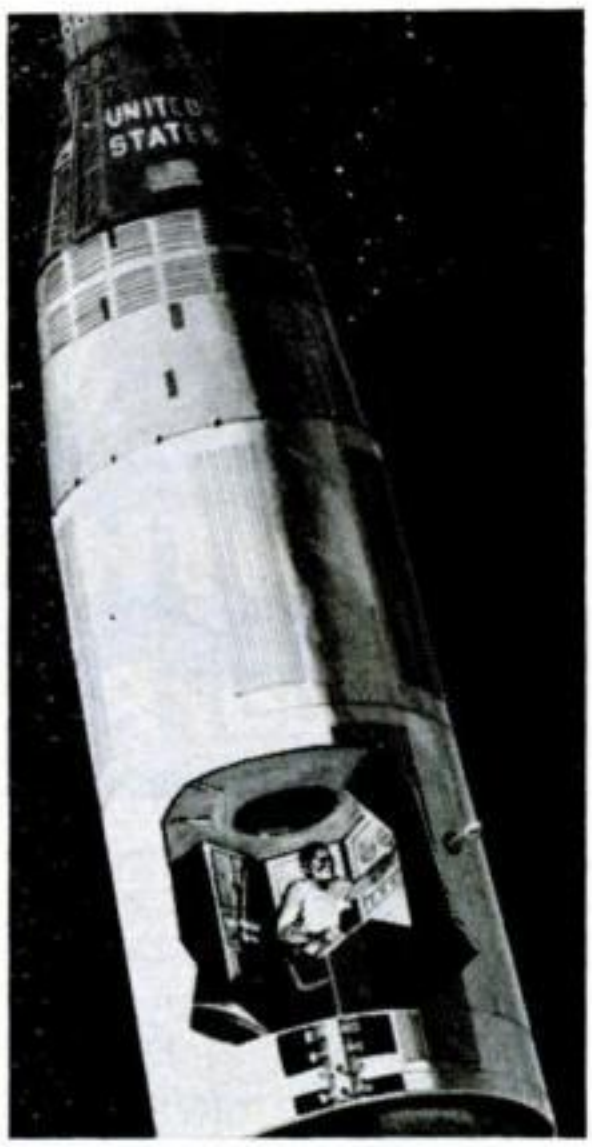
Air Force "MOL" will house two men in orbit up to 30 days

Secrets of Sleep Found in the Blood Of Dozing Rabbits

Sleep is an every-night experience for man and animals, but its nature is still a puzzle. One of the ideas scientists have had is that chemicals accumulating in the bloodstream help to put you to sleep. This has now been confirmed by Drs. M. Monnier and L. Hösli of the University of Basel, Switzerland—and their experiments have added a new element to the puzzle.

They circulated the blood of sleeping rabbits through apparatus that allowed some substances from the blood to ooze through a membrane. This extract was injected into wide-awake rabbits, and it put them to sleep. But the real surprise came when they used an extract from the blood of alert, well-rested rabbits. Injected into sleeping rabbits, it woke them up and made them frisky.

Apparently the body is capable of producing not only its own sedative, but also its own stimulant. No one knows what these substances are yet, but if they can be identified, they may turn out to be better than any of the sleep pills and pep pills we have today.



What MOL will look like

Gemini Capsule to Be Set Atop Giant Cylinder

Plans for America's first space station are going full blast, now that Defense Secretary Robert S. McNamara has authorized over $150 million for the "Manned Orbiting Laboratory" (MOL), which is a project of the Air Force rather than the National Aeronautics and Space Administration. (This was anticipated by Dr. von Braun in PS last month.)

The Air Force's Space Systems Division is in the midst of the involved series of steps necessary to determine what company will build the space station, and that is expected to take most of this year. But earlier studies show what the space station will look like.

It will consist of a conical Gemini capsule on top of a cylinder (left) the size of a house trailer. The Gemini spacecraft will be used for return to earth on completion of the mission; while in orbit, the two-man crew will live and work in the cylindrical can.

Close Quarters

Life will be cramped in the MOL. Within the cylinder, 14 feet long and 10 feet in diameter, there will be two compartments. The smaller one will serve as an airlock to get to the Gemini capsule. The other must function as living quarters for up to 30 days in space, but will also be used as a laboratory, jammed with scientific equipment.

The first experiments will

Continued on page 23

Scarcest Vitamin in the West

Last summer's drought may create a unique problem in cattle production this year, Colorado State University agricultural experts think. In some states, cows had so little green fodder to eat that they are running out of vitamin A. Normally, they can store up enough of the vitamin to tide them over a few months, but they've been on dry rations for too long. Unless the cattle get emergency shots of vitamin A, this spring is likely to see a poor calf crop and other breeding problems.

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deal with the physical limitations of man under weightless conditions in an atmosphere of pure oxygen. Later, if man's worth in space is proved, the Air Force spacemen are likely to concentrate on military tasks.

An Eye on the Reds

Foremost of these is expected to be reconnaissance—observing Communist territory. We now have unmanned reconnaissance satellites in orbit, taking pictures of Red ground installations and sending them back, but such devices have limited flexibility. Men in space would be able to concentrate on significant targets, aiming cameras, telescopes, and other sensors precisely so as to yield the maximum amount of information.

Other possible jobs for the inhabitants of the space station include repairing out-of-order satellites, inspecting Russian satellites, and studying the feasibility of firing weapons at ground targets from space.

It will probably be three years before the first MOL can be placed in orbit, because of the many steps in the process of assigning contracts, developing hardware, and building the station. But the project to build an American space station is under way at last.

What's behind the "news" about a new Panama Canal

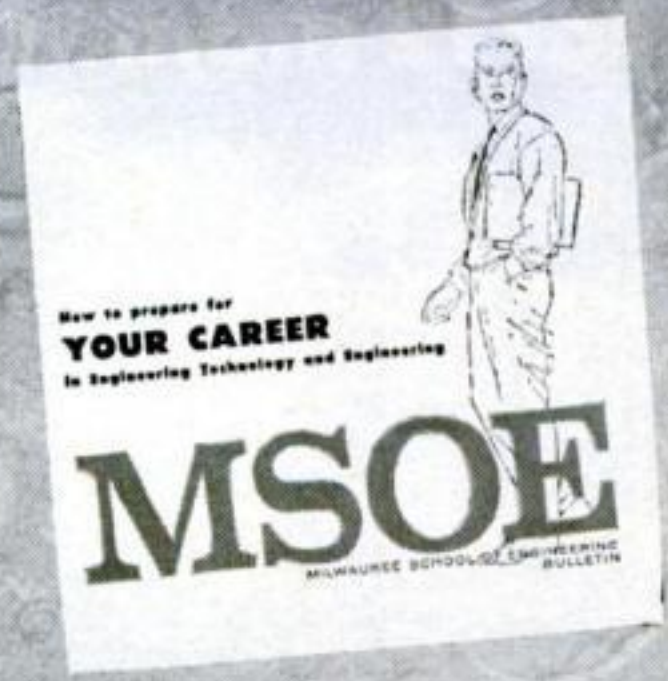
Contrary to headlines about a "new" Panama Canal, announced by President Johnson, it's unlikely that work on such a project will be started for many years to come. The essential content of the President's statement was that surveys of four possible sites would be conducted over a four-year period, and it was conceded that improving the present canal is the most likely project to be carried out. The whys and wherefores behind this were explained in the PS article, "Do We Need Another Panama Canal?" [Aug. '64]. The President's announcement gets its real importance as a diplomatic maneuver in the negotiation of a new treaty with the government of Panama.

Drug that prevents colds promising in early tests

A chemical vapor, slowly evaporating from a moist cotton pad in your bedroom, may keep you from catching cold all next winter. The chemical called viractin, a byproduct of

Continued on page 26

Thinking of college and a space age career?



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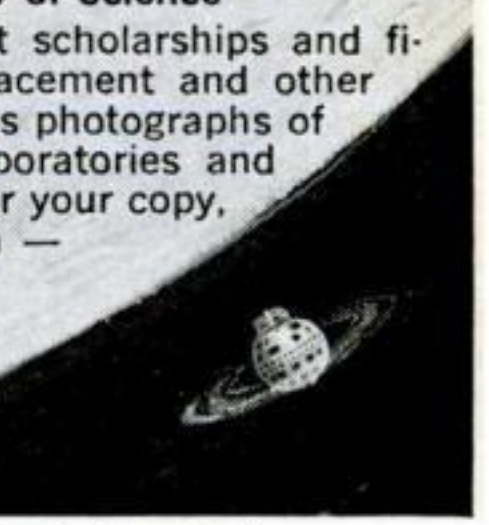

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antibiotic manufacture, was discovered by Dr. Byron E. Leach, a biochemist of the U.S. Department of Agriculture. It has been tested in sleeping wards of a Veterans Administration hospital, where it completely protected 310 patients from upper-respiratory infections, while other patients in the same hospital came down with the usual colds. Additional tests are being carried out, and Dr. Leach plans to apply to the Food and Drug Administration for licensing of the drug.

As Confucius might have said, that's how the egg rolls

The question of which came first, the chicken or the egg, has never been laid to rest, but at last another long-unanswered question has been: Which *end* of the egg is laid first, the round end or the pointed end?

You can find the answer in a newly published 918-page book, *The Avian Egg* (by A. L. and A. J. Romanoff of Cornell University), which undoubtedly tells more about hens' eggs than most people want to know.

With characteristic thoroughness, the authors trace the evidence on which end comes first back to Aristotle's interest in the subject. The conclusive data, however, has been accumulated in modern times.

It turns out that about 90 percent of the eggs have their shells formed while the sharp end points downward, but only 70 to 80 percent are laid sharp end first. What happens? Well, some eggs rotate end for end as they are squeezed along in the hen's oviduct, and it's a matter of chance which end comes out first.

The hen has no choice in the matter, and the only people who really care are scientists in their search for truth.

Aerial fertilizing promises Garden of Eden

Feed plants in a greenhouse large draughts of carbon dioxide and you get dramatic increases in plant growth, claims the Whirlpool Corp., Benton Harbor, Mich. The company's Tectrol division makes a carbon dioxide generator—essentially a propane or natural-gas burner—which pipes in CO_2-enriched air. The effect is said to emulate conditions on earth in primeval times, when there was much more carbon dioxide in the air than there is now, resulting in the growth of lush forests and jungles. ■ ■

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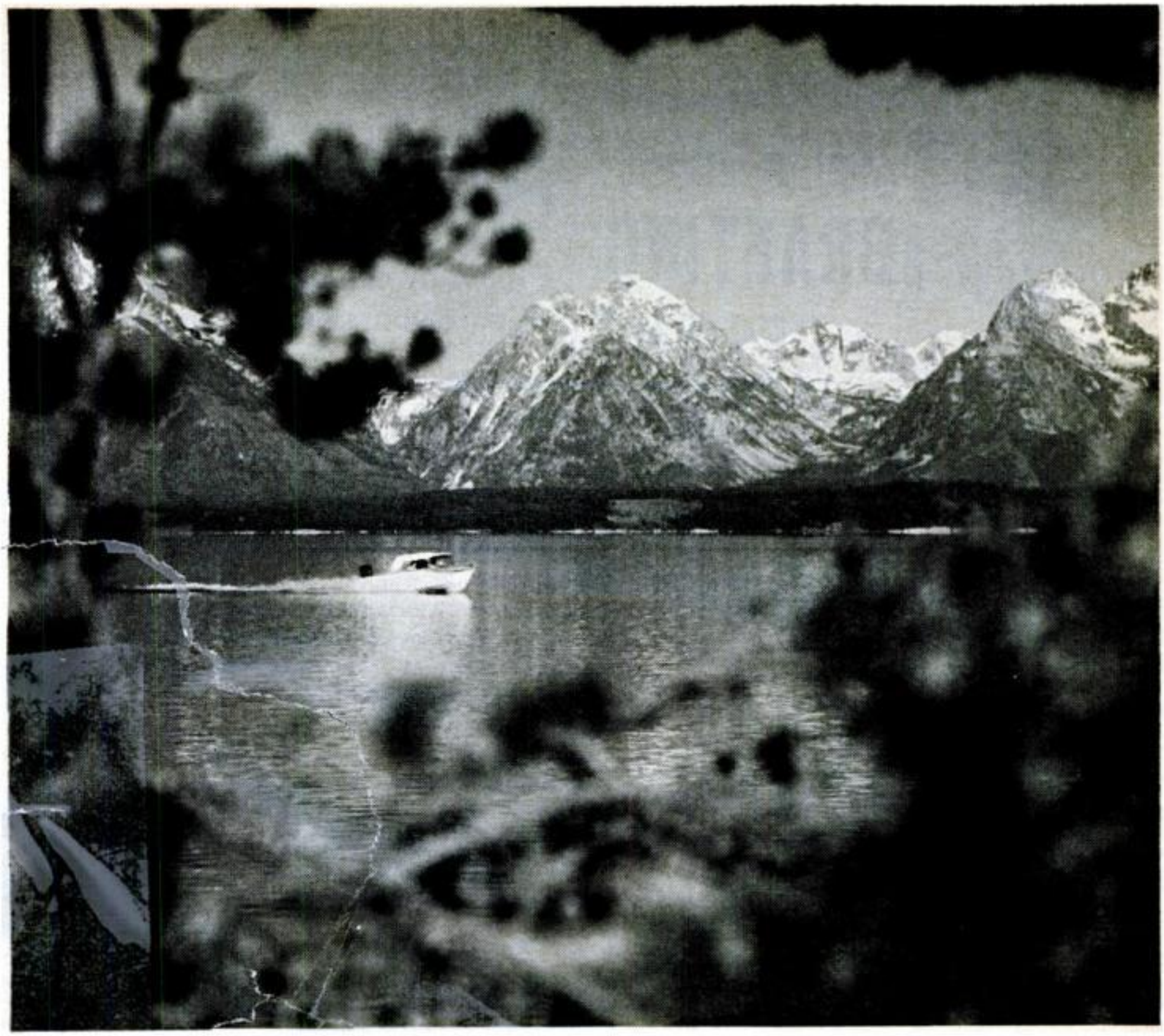
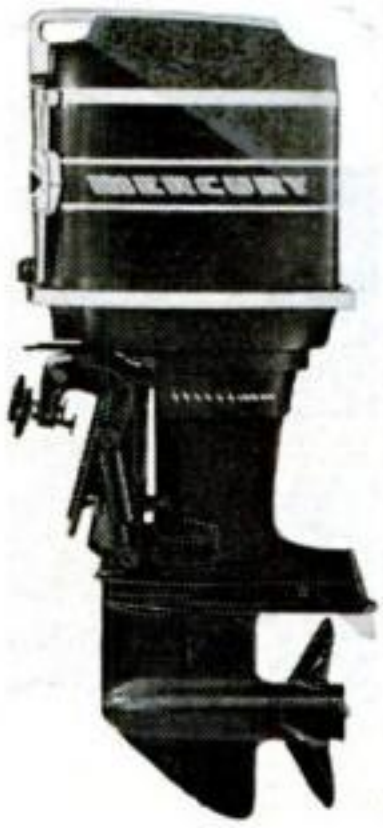


a Merc doesn't disturb the peace

There's a new sound on the water for 1965 . . . a new quiet sound, 50% less than before. It's the sound of the new 1965 Mercs. Silencing came, primarily, from two new principles:

- Engine cooling water surrounds Merc's new internal exhaust pipe and prevents noise from escaping through the sides of the drive shaft housing. This wall of water pressing against the inside of the housing also damps out mechanical vibration.
- Mercs have a new, non-broadcasting cowling that is isolated from engine operating sounds by large, soft-rubber mounts. The cowling actually "floats" around the powerhead. All openings for controls are sealed with neoprene to insure that sound is trapped inside the cowling.



Dyna-Float, aircraft-type suspension . . . an elastically isolated remote steering control arm . . . offset wrist pins . . . small-bore, short-stroke design . . . these are just a few more of the reasons why Mercs are 50% quieter.

While other manufacturers attempt to quiet their engines by padding in the sound, Mercury has engineered it *out* in 15 different ways, from the rubber floated cowl all the way down through the Jet-Prop exhaust. That's why you'll always get more RUN for your money with Mercury . . . 3.9, 6, 9.8, 20, 35, 50, 65, 90 and 100 hp.

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Getting Ahead

A monthly column to help you prepare yourself for a better job

By Dr. Lewis R. Fibel

TO KEEP ahead of technological change, Chicago has been forecasting its educational and manpower needs for the next 20 years. The result: an eight-volume report with implications for us all.

It points out, for example, that electronically controlled metalworking equipment by 1980 may wash out the jobs of 150,000 machinists in the U.S. But 200,000 programers will be needed to run the machines —and many could be retrained machinists.

To give workers the chance to gain new skills, massive growth in part-time education (night schools) is expected. Because of shortages in facilities, equipment, and instructors, the schools, industry, and labor will have to set up cooperative programs.

"What government agency makes loans for educational purposes, to be repaid after graduation?"—L.D.W. Robbinsdale, Minn.

No government agency makes direct loans to students. Under the National Defense Student Loan Program, colleges get funds to make loans to needy students. Many colleges are participants in the program. Principal and interest are repayable after graduation and may be scheduled over a 10-year period. Apply for a loan to the college of your choice.

In some states, state-guaranteed loans are made to college students by banks. There are also time-payment plans available through private agencies. There are many ways of financing a college education. Explore them fully with a college financial-assistance officer.

"Can you list some schools of mechanical dentistry?"—R.F.W., Shelby, Mont.

Booklets on this career are published by Chronicle Guidance Publications, Moravia, N.Y. (35 cents); Science Research Assoc.,

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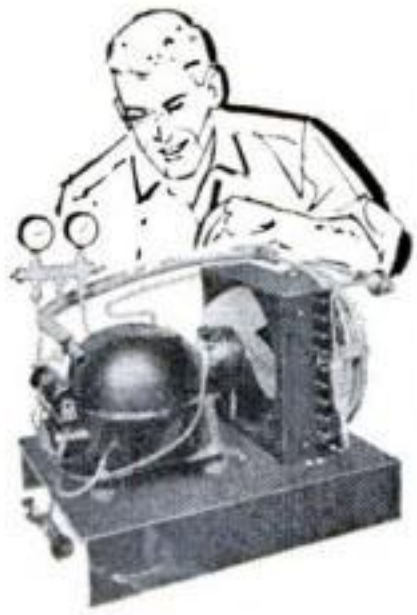

IF YOU REALLY WANT TO GET AHEAD —
If you *want* to earn big money in a booming field—it will pay you to get the facts about fast-growing Air Conditioning, Refrigeration and Heating. This industry is demanding more men than we can possibly train. More than 20,000 mechanics must be trained *every year.*

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YOU CAN DO IT
No matter what kind of work you happen to be doing right now, ask yourself, "Am I getting ahead—*really* getting ahead?" "Am I doing what I want to do?" "Am I so challenged and excited by my work I can't *help* but do a good job?" "Am I making enough money?" If for any reason you're not satisfied, you may secretly be itching for a business of your own or a better job—or exciting and profitable part-time work. That's where CTI comes in. You can learn refrigeration and air conditioning step by step, by DOING. You build a complete refrigeration system right in your home and probably MAKE MONEY WHILE YOU'RE LEARNING. All you have to do is give this easy-to-follow course an honest try. Start now. You're missing valuable income if you delay. Mail the Certificate and all the facts will be in your hands within just a few days. No obligation.

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Getting Ahead continued

57 W. Grand Ave., Chicago 10 (45 cents); Mich. Employment Sec. Commission, 7310 Woodward Ave., Detroit 2 (25 cents).

Junior colleges offering courses: City College of San Francisco; Vallejo (Calif.) Junior College; Pensacola (Fla.) Junior College; Chicago City Junior College; NYC Community College (Brooklyn, N.Y.).

Trade schools: Boston School of Mech. Dentistry, 121 Bay State Rd., Boston; Newark School of Mech. Dentistry, 127 Mulberry St., Newark, N.J.; N.Y. School of Mech. Dentistry, 290 7th Ave., NYC; Durham Indus. Ed. Center, Box 1341, Durham, N.C.; Elkhart U. of Med. & Dental Technique, Elkhart, Ind.

"I've had two years of college, am now a programer, but I've always had a yen to be a high-school teacher. Would I be foolish to abandon my job to work for a teaching certificate?"—J.L., Boston.

Sounds as if you're in a good spot for adding to your present skill and enjoying your work, too. As indicated at the beginning of this column, there will certainly be a shortage of teachers qualified to teach industrial (vocational) arts. Why not shoot for this?

"Next fall, I enter college and I don't know what I want to be. My main interest is the outdoors. What courses lead to an outdoor career?"—R. A., Albany, N.Y.

Don't be upset by not having a specific career goal right now. This is true of young men more often than not. One virtue of college is the opportunity it offers to explore any avenue that might interest you, certainly for the first two years. I'd suggest that you consider a liberal-arts program. Take some biology, some other sciences, many of the social sciences, and as much of the humanities as you can. Read widely in fields that interest you, talk with people in them, and try for summer jobs to help make a decision. Your goals will then crystallize.

"I'd like to be a mortician. Any schools in my area?"—T.P.G., NYC.

Funeral directors are state licensed. Many states require two years of college, nine months to three years of specialized

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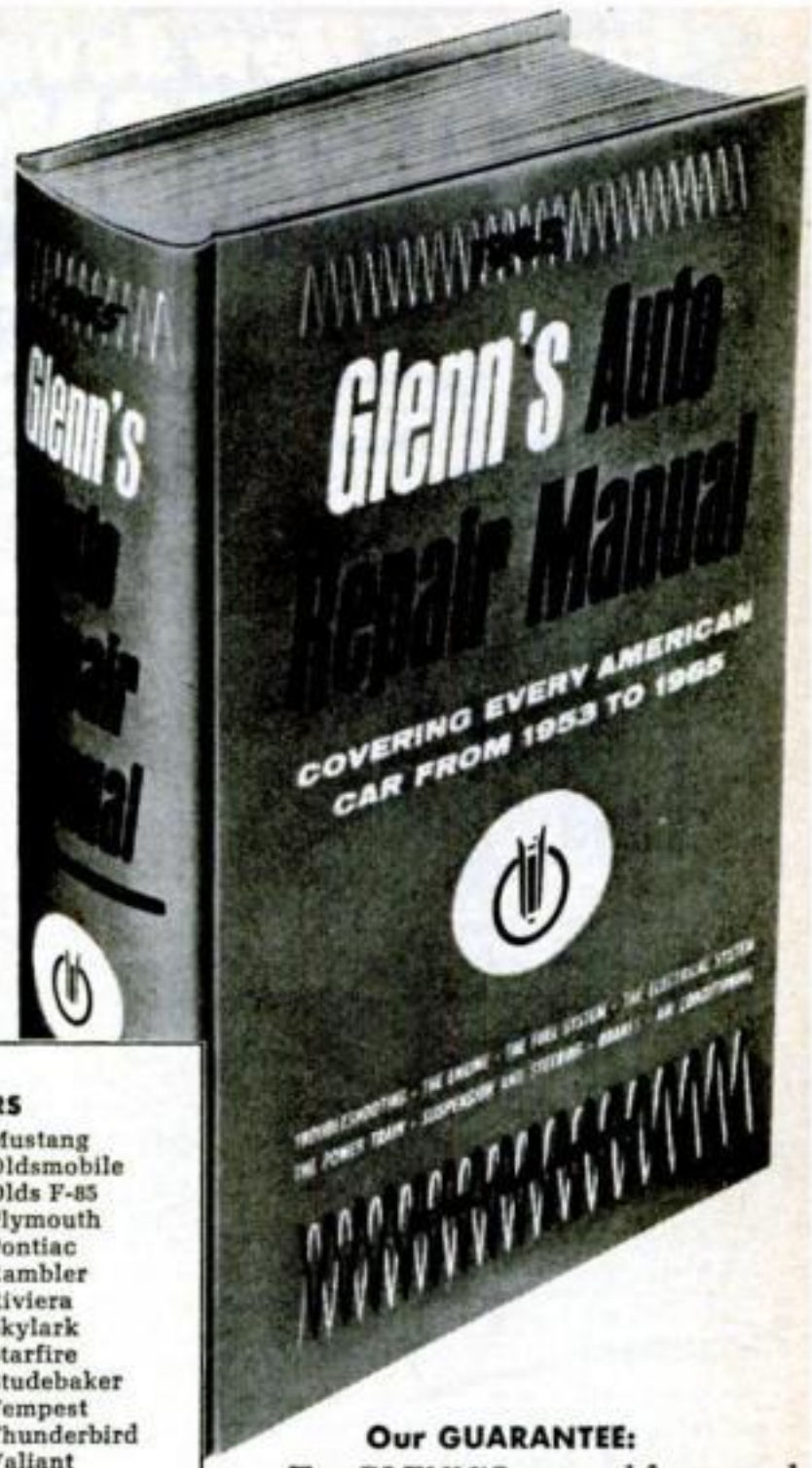

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Getting Ahead continued

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"Although handicapped with one arm, I'd like to learn to repair small home appliances. Where?"—J.W.M., Clearwater, Fla.

Almost every state's Education Department has a Division of Vocational Rehabilitation that will (without cost to you) provide career guidance and counseling. They can suggest local agencies able to give you needed training, and may provide funds to help defray training costs. If you are a veteran, check the VA for help, too.

You might wish, on your own, to investigate opportunities offered by the Institute for Crippled and Disabled, 400 First Ave., NYC; Bulova School of Watchmaking, 40-24 62nd St., Woodside, N.Y.; Detroit League for the Handicapped, 1401 Ash St., Detroit; School of Tech. Training, Oklahoma A & M College Rehabilitation Center, Okmulgee, Okla.

"I'm thinking of studying electrical drafting? Is there a good future in this?"—R.M., Johnson City, N.Y.

Electrical (or electronic) draftsmen should be in growing demand through the sixties. Their job is to prepare drawings from sketches and specifications furnished by engineers, translating rough ideas into complete and accurate working plans. They also may make calculations on strength, reliability, and cost of materials, and check dimensions of parts and their relationships.

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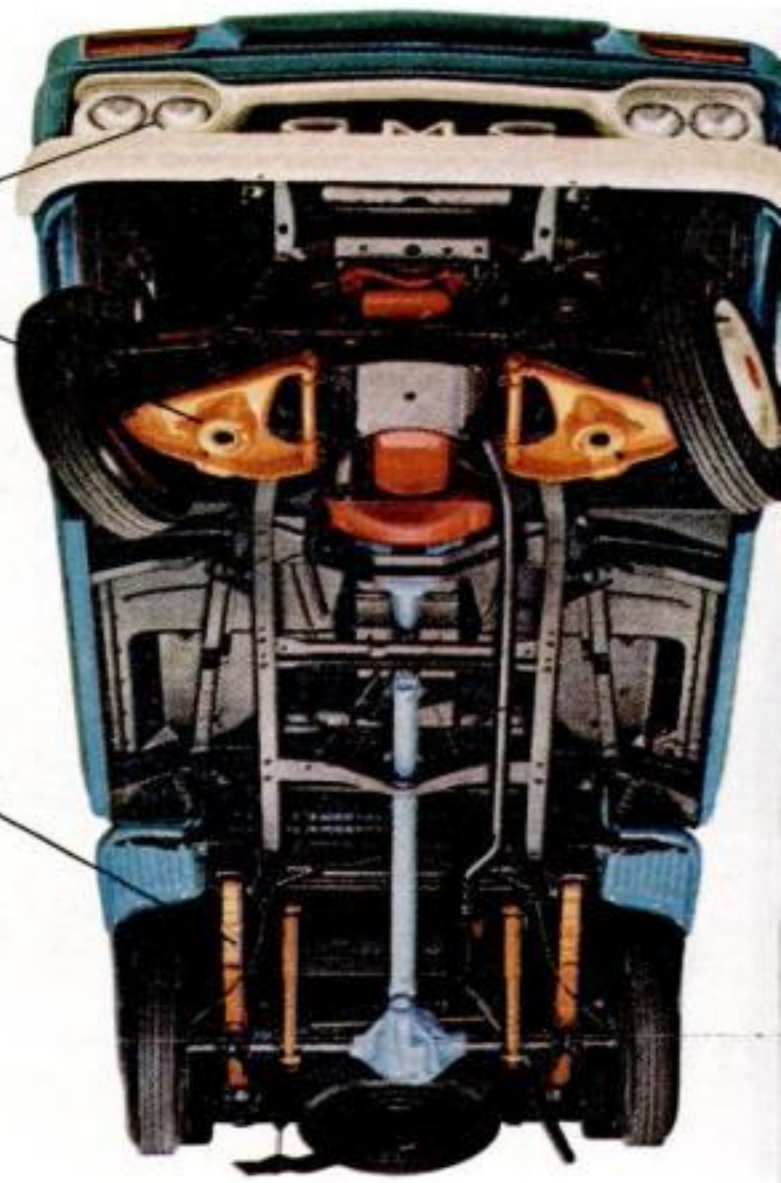

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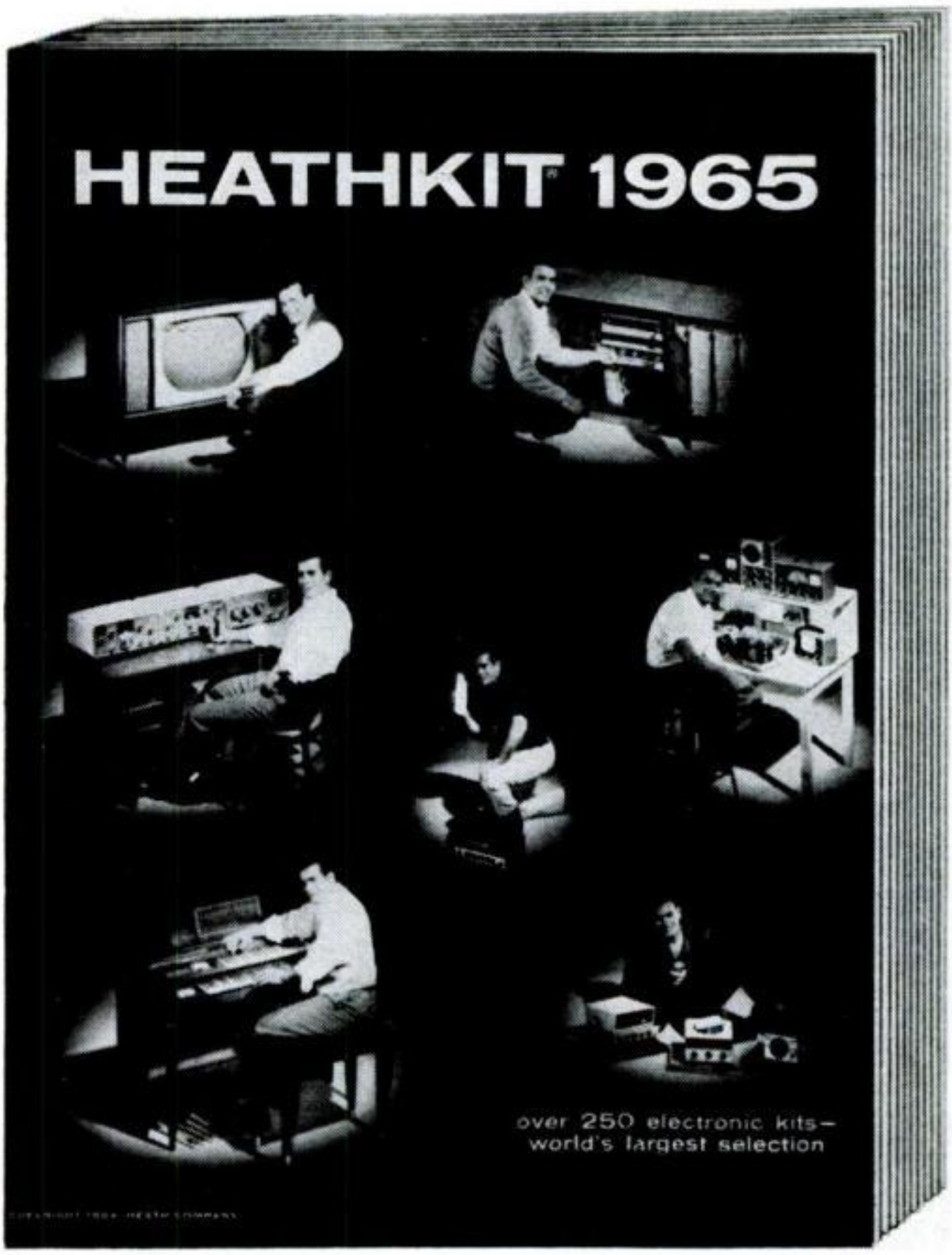

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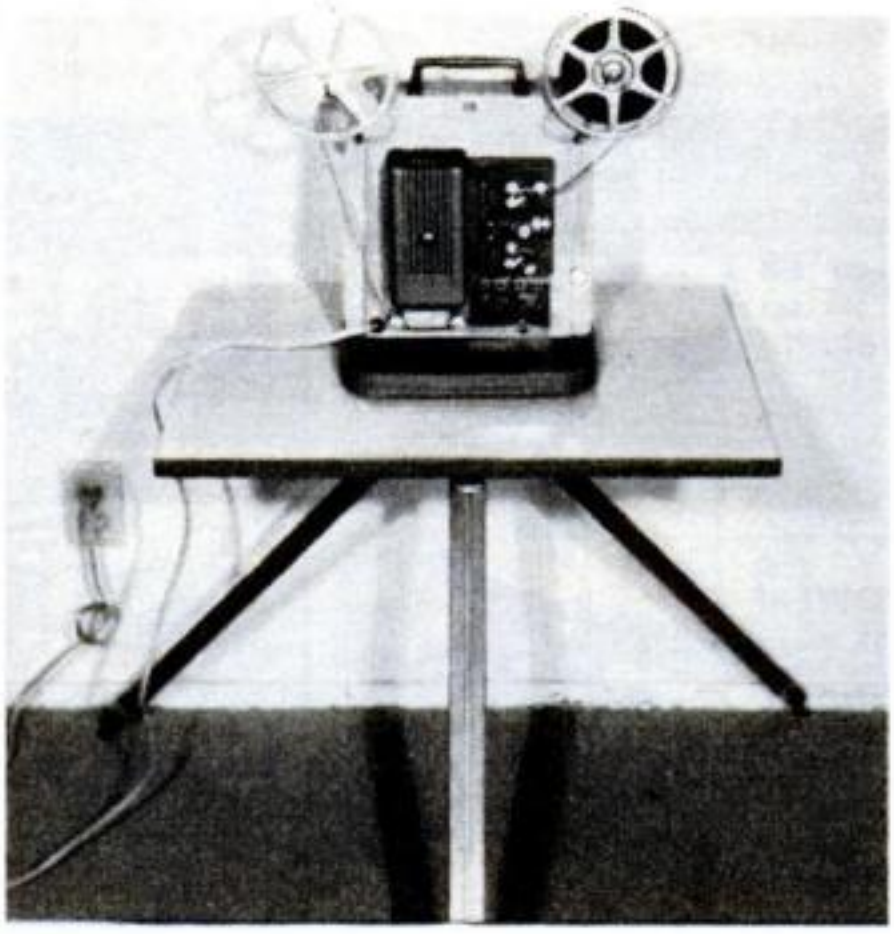
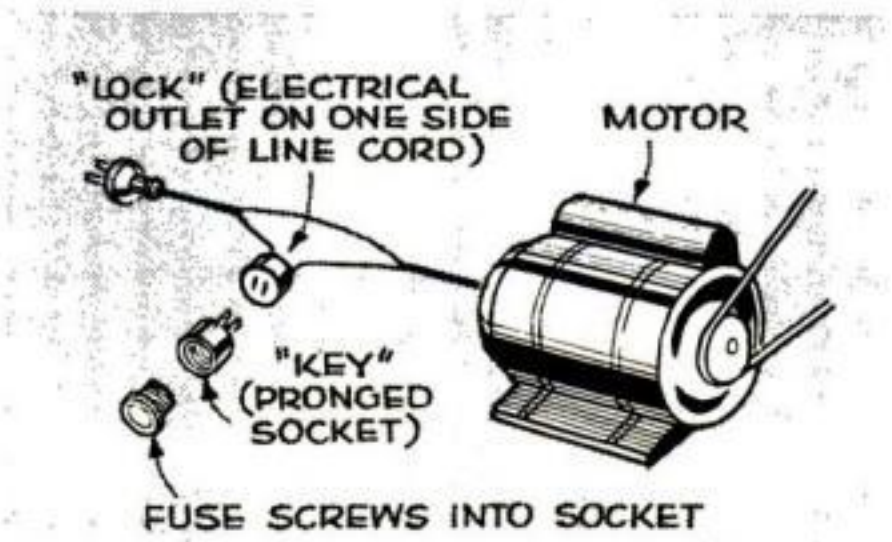


Old tripod becomes a projector table

An old wood-leg camera tripod makes a good base for a projector table or similar stand that must be put up and taken down often. It lets you adjust the table's height and set it level. The top shown here was attached with a ¼"-thick metal plate screwed to the underside and drilled and tapped ¼"-20 to match the tripod screw. This lets you remove the top quickly for storage.—*Eric E. Swanson, Whittier, Calif.*



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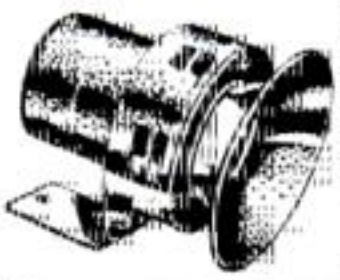

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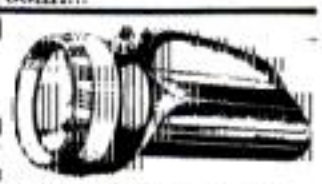

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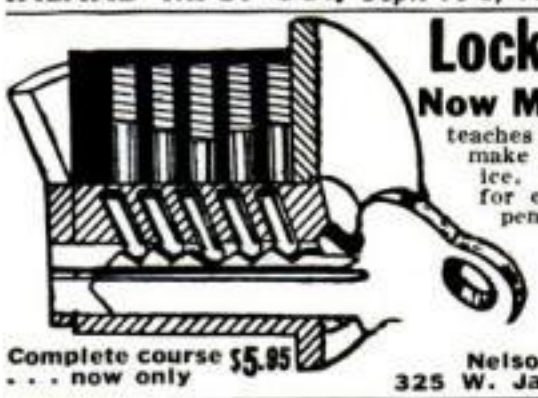

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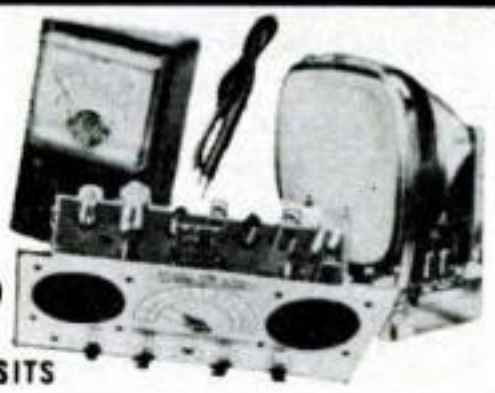

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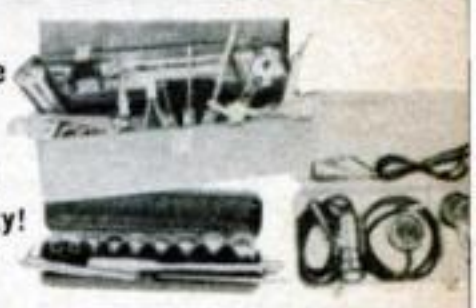

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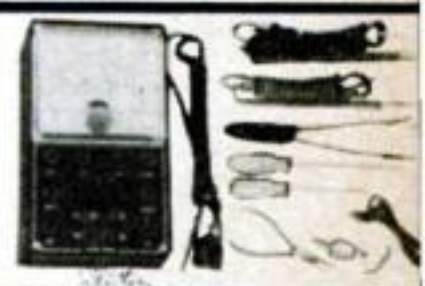

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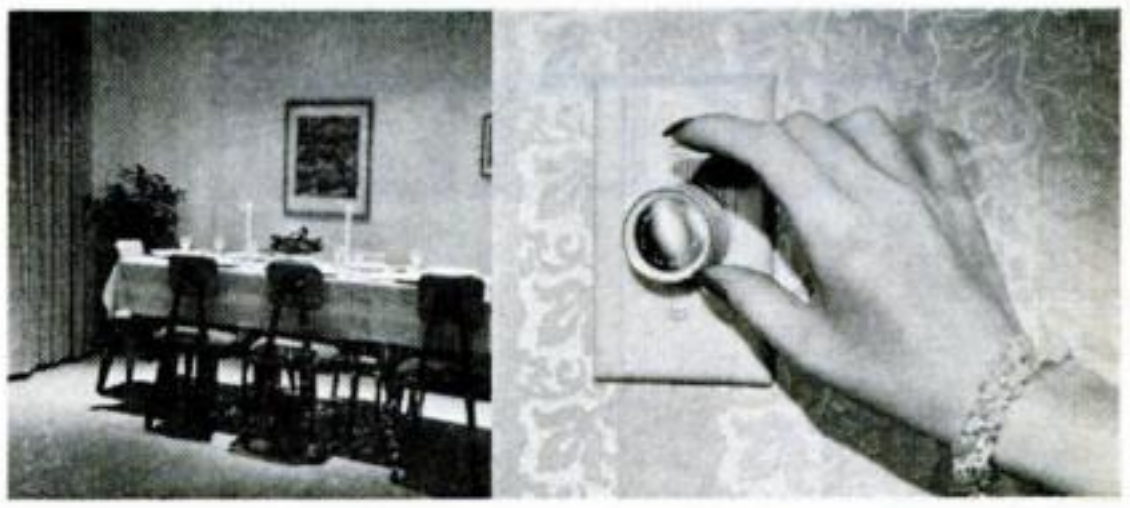

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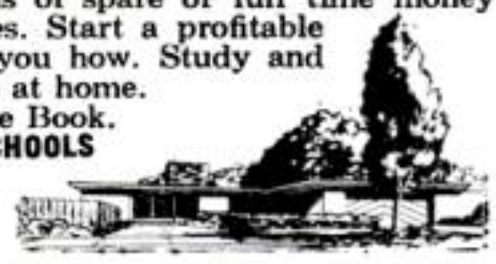

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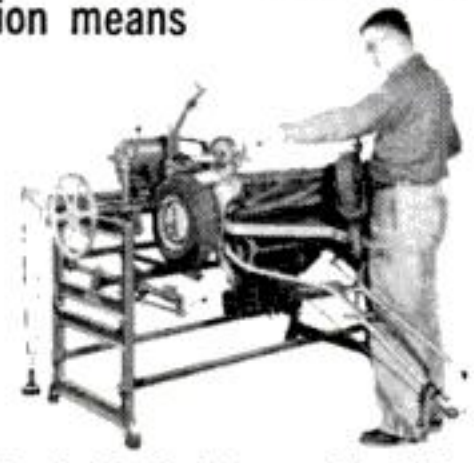

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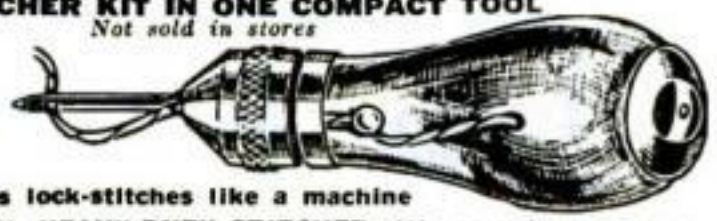

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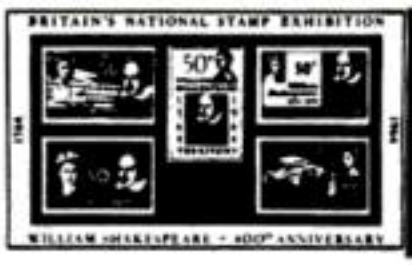

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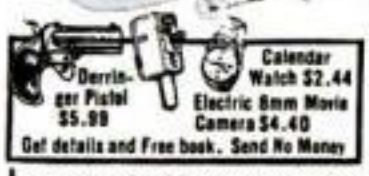

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Detroit report...

A MUSTANG-SIZE--OR SMALLER--SPORTS CAR FOR PONTIAC?
Could be. Reports say Pontiac is working on one for introduction this fall. It might be powered by a long-rumored overhead-cam straight six. This would be Pontiac's answer, within the GM family, to Chevy's Corvette, Buick's sporty Riviera and Gran Sports Skylark, and Olds' front-wheel-drive Holiday. That leaves the question of what Cadillac may do. Want an educated guess? A luxury personal car with front-wheel drive.

ONE F-W-D (SOMETIMES) FOLLOWS ANOTHER. If the Olds front-wheel drive gets popular, Ford, and perhaps even Buick, will introduce something comparable. Ford is flirting outrageously with an f-w-d Thunderbird for 1967. The under-hood layout of engine, transmission, torque converter, and differential would be similar to Olds'. Sporty cars? The Ford empire may tap Mercury to produce a two-seater that would resemble the Mustang I, the "idea" car that toured the country in 1962. It could use the V-4 that powered the Mustang I or the V-6 from the German-made Ford Taunus. One Ford goal on any sports car: a price under $3,000.

CHRYSLER PLANS TO MAKE ONLY 500 OR SO TURBINE CARS for the regular retail market in the next model year. These may appear with the regular lines of cars in the fall, or may wait until early '66. The company expects no surge of public demand for turbine cars unless the metals problem is solved. The engine now operates at 1,700 degrees F. maximum temperature. Any increase in that isn't possible with the present low-cost metals being used. But if cheap metals turned up that could take 200 to 300 degrees more heat, efficiency would soar, and the turbine car could then become a big-quantity item.

AN ACCELERATED TRUCK-TURBINE PROGRAM at GM's Diesel Division quietly began last September--speaking of turbines. And some of the men on the project are right out of Chrysler's turbine workshop. They will refine an engine developed by the long-hair scientists at the GM Technical Center.

THIS AND THAT: Engineers are having trouble replacing vent windows with straight-through ventilation for '66 cars--under test at high speed, the big, curved side windows break away from the weather seal at the top . . . All rental vehicles built since Jan. 1 must have odometers accurate within plus-or-minus 3.75 percent--by fiat of the U.S. Bureau of Standards and the National Conference on Weights and Measures.

Devon Francis

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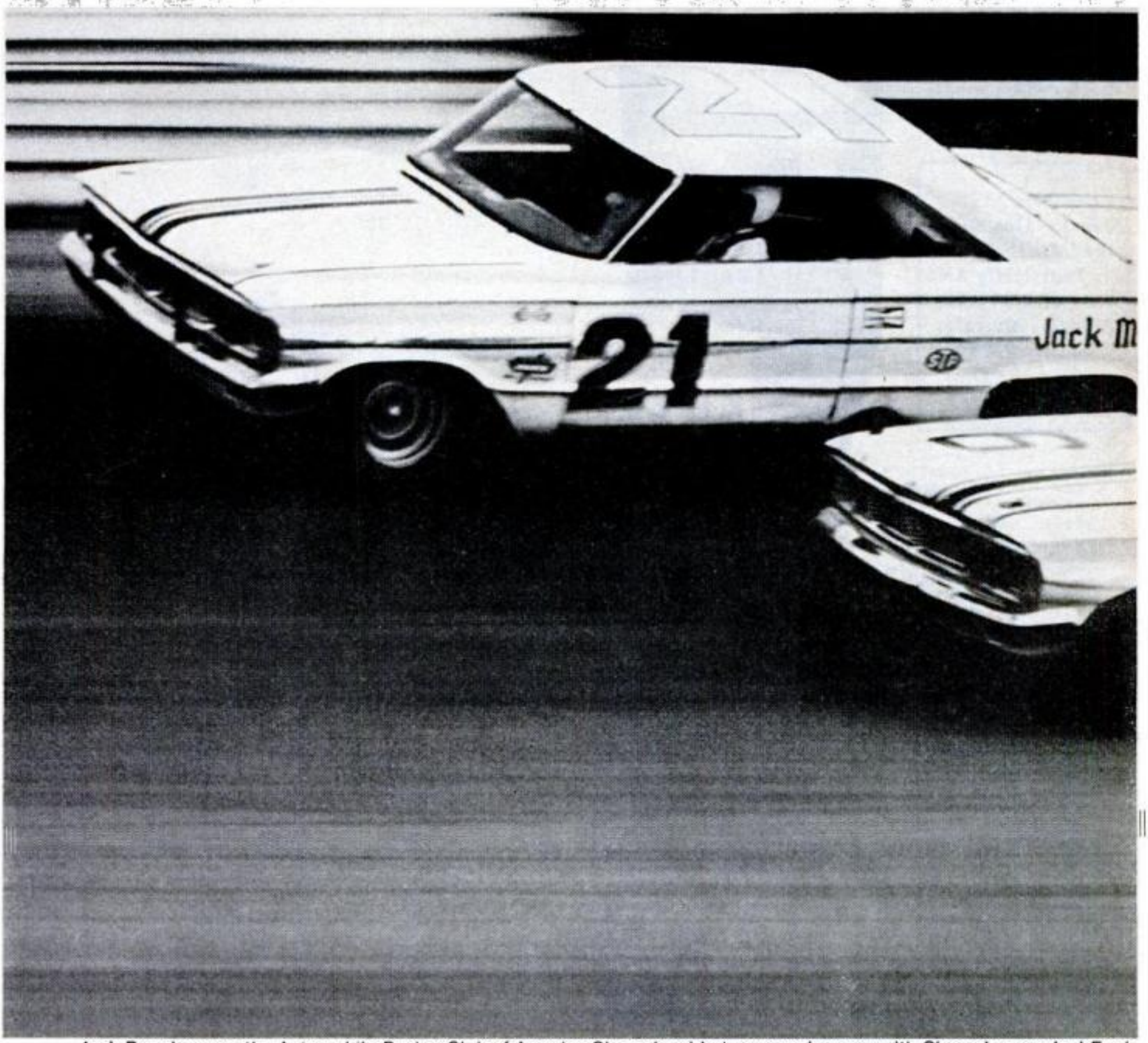

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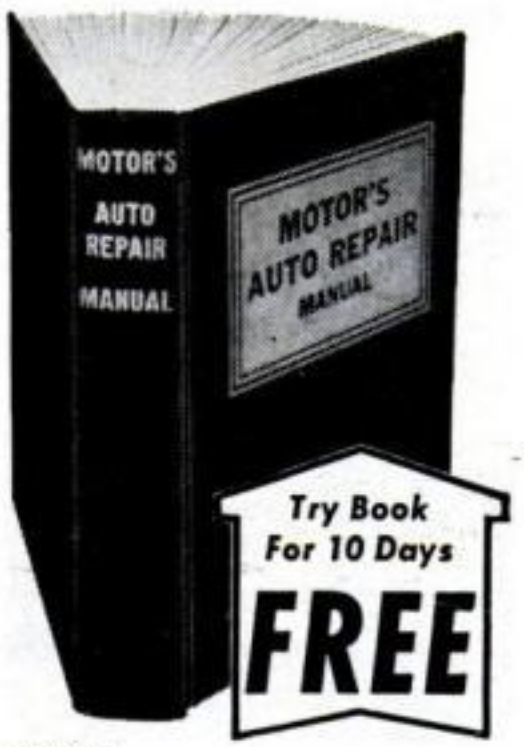

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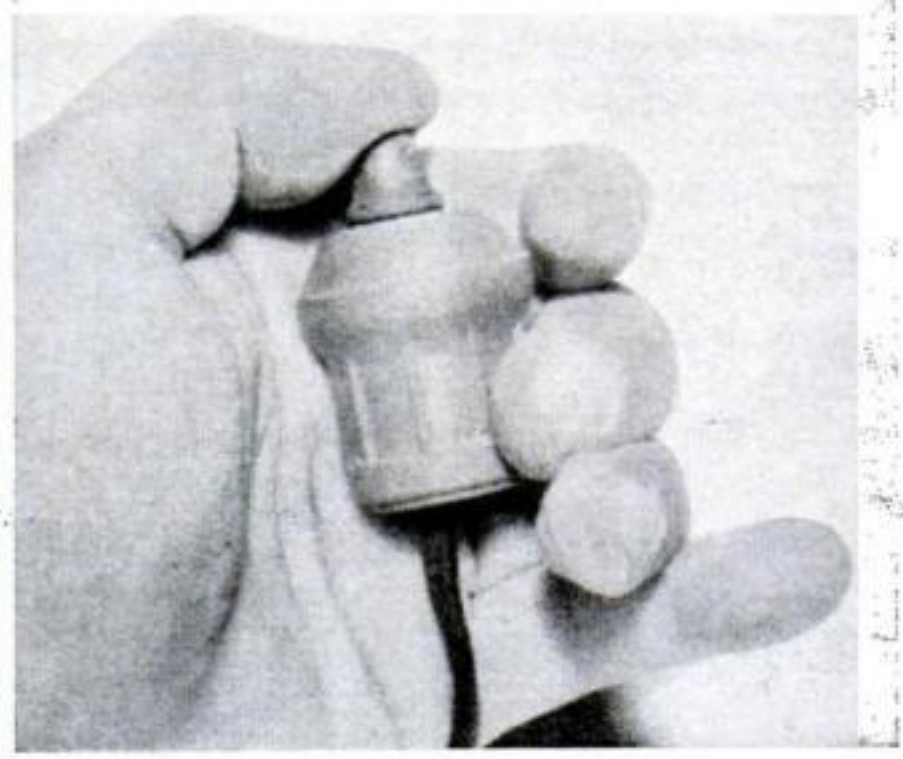
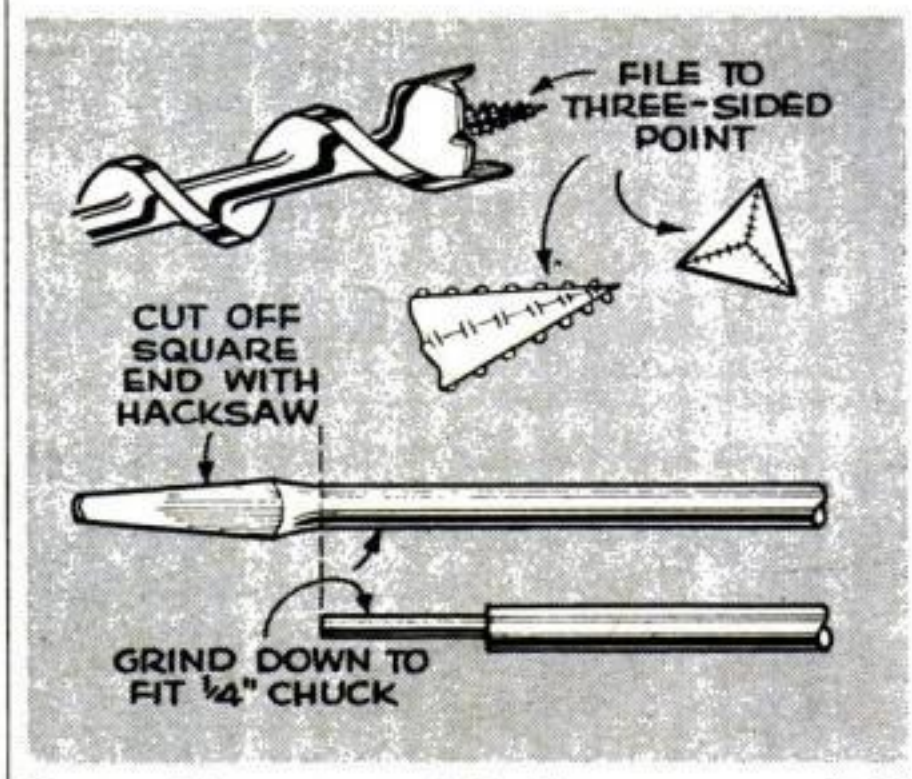


Hand switch housed in a crutch tip

A rubber crutch tip makes a perfect housing for a hand-held pushbutton switch. Cut a hole to let the switch button stick out, and use plastic calking compound to seal the switch inside the tip.—*Henry A. Rosenblatt, Newton Centre, Mass.*



Converting auger bits for a power drill

Ordinary auger bits can't be used in an electric drill or drill press because the screw point pulls them into the work uncontrollably. File the screw tip to a smooth, triangular point, as above. This point will readily enter the work while leaving you in full control of the feed. Saw off the square, tapered end of the shank. If your drill chuck won't open far enough to take the straight part, grind or file the shank down, being careful to keep it centered.—*Stephen L. Walton, White Plains, N.Y.*

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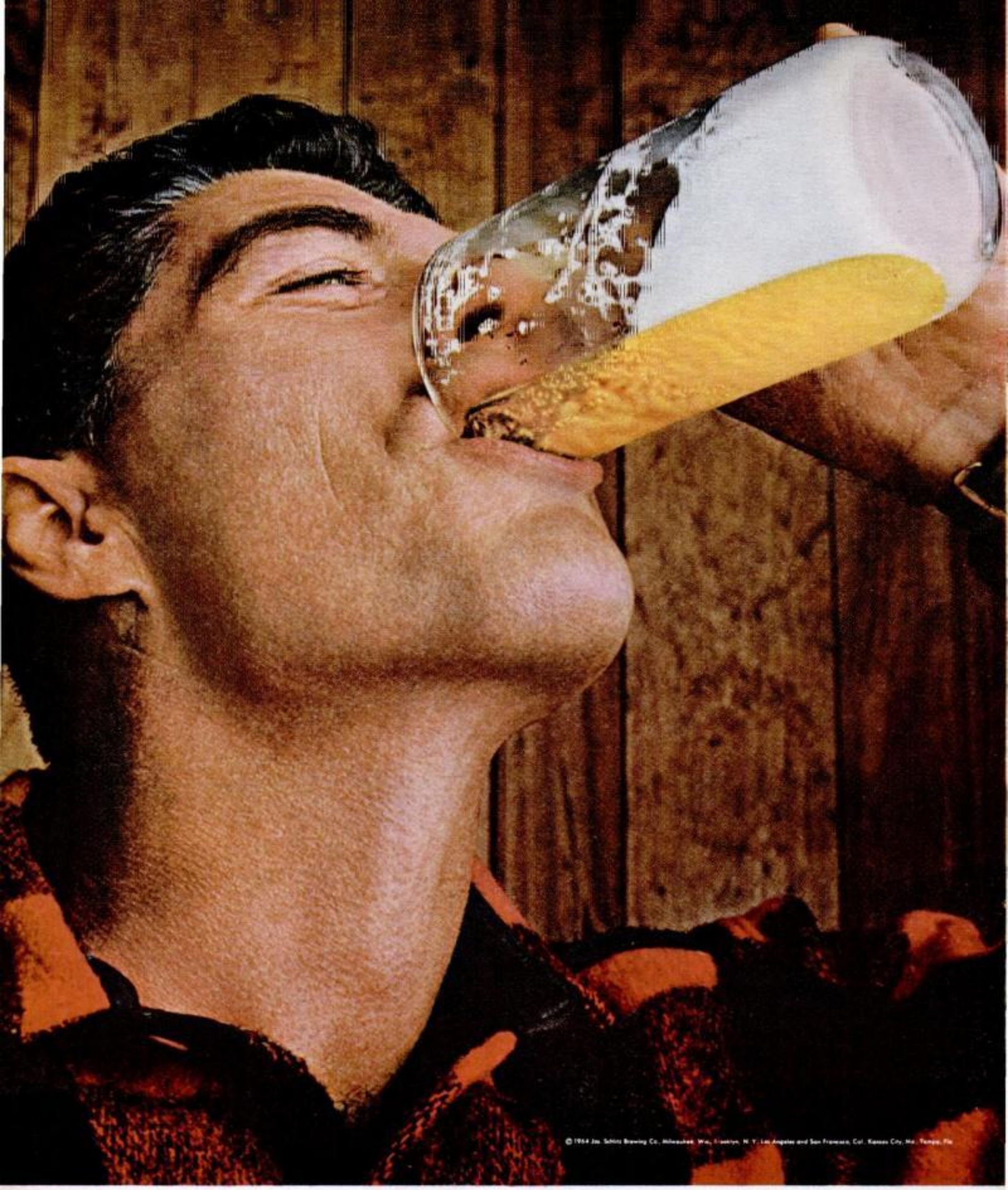

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"Me? In *that*?"

When you take your wife to see the Volkswagen Station Wagon don't be surprised if you have to drag her.

"But it looks silly."

That's your first problem: you have to explain the flat face and square shape.

The front is flat because the engine is in the back. This eliminates a long hood and makes our wagon almost as easy to park as our sedan.

(There's only 9 inches difference.)

And the square shape holds almost twice as much as an everyday station wagon.

170 cubic feet.

Once you coax her behind the wheel, be ready for something like this:

"But it's like sitting in a fishbowl."

She's right, it is. There are 21 windows.

And if she handles the family checkbook, you might show her a few numbers:

24 miles on a gallon of regular gasoline. 35,000 miles on tires. 4 pints of oil, not 4 quarts.

If you can sell your wife on the Volkswagen Station Wagon, consider yourself a star salesman.

We certainly will.

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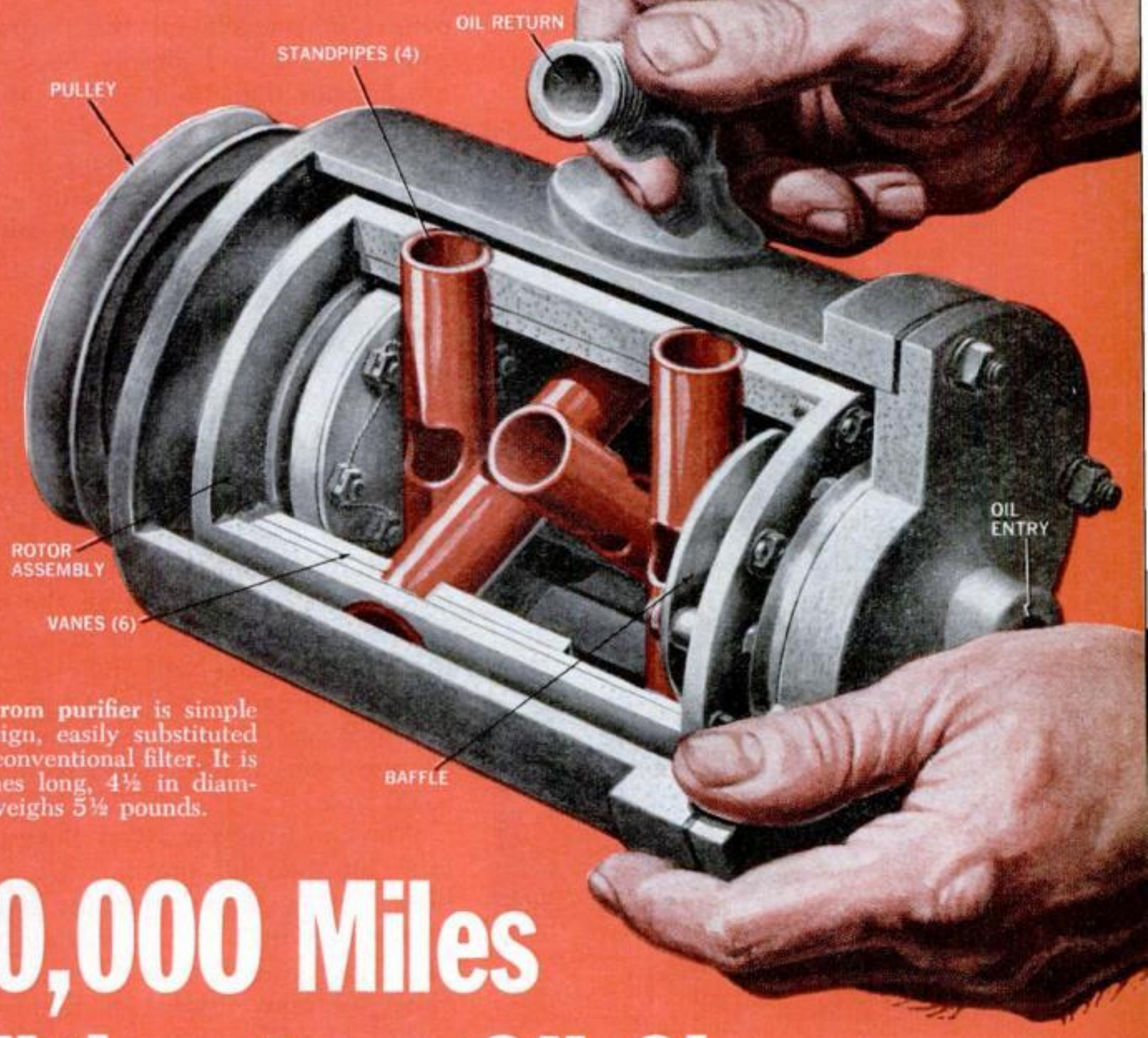
Exclusive report: Popular Science runs a test of an experimental filter—with results that may affect every motorist



Bergstrom purifier is simple in design, easily substituted for a conventional filter. It is 9 inches long, 4½ in diameter, weighs 5½ pounds.

50,000 Miles Without an Oil Change

By Devon Francis and Denis Sneigr

A DECEPTIVELY simple piece of machinery that works like a farmer's cream separator may enable millions of motorists to drive their cars 35,000 miles between oil changes.

And even that figure may be low. POPULAR SCIENCE participated in a test in which oil was driven 50,000 miles.

This thing is kooky. It shouldn't work. Several times in the course of the test, laboratory reports indicated that it wasn't doing the job it was intended for. But the principal test engine wound up—after eight months of hard driving—

CONTINUED

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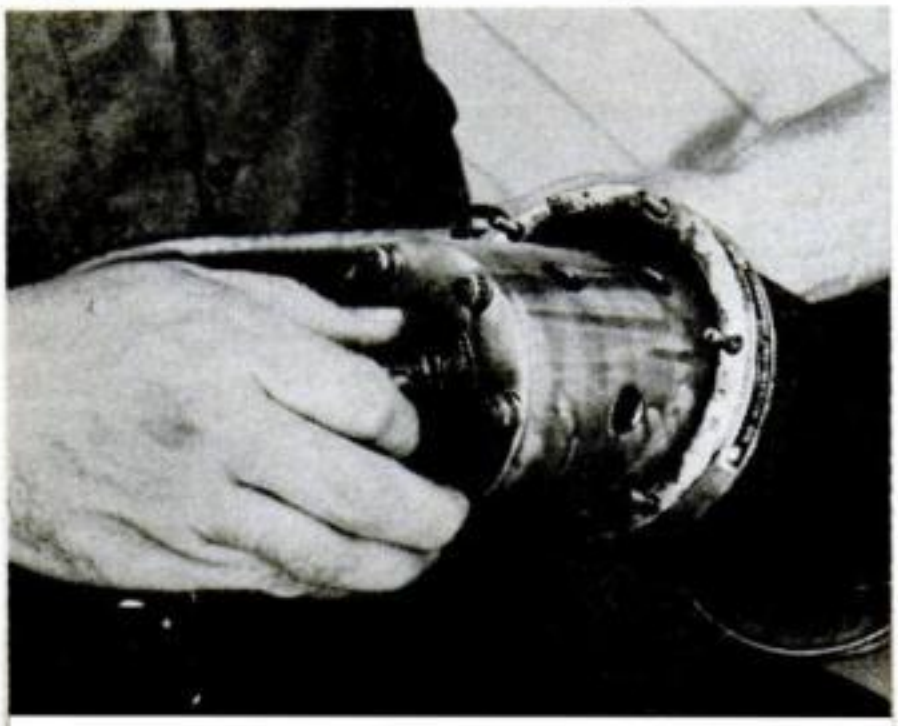
New way of removing impurities from engine oil may well

tight, sassy, and apparently good for another 50,000 miles.

The "piece of machinery" is a new kind of oil filter, or purifier. Instead of using filtering elements to *strain* impurities from oil, as a housewife uses a colander, this filter (or purifier) gets rid of them by centrifuging.

Oil was drained from purifier for test purposes before rotor was removed for cleaning out sludge. A production unit could be kept free of dirt without removal from the engine.

Cleaning sequence requires removal of rear cover, then withdrawal of the rotor, which collects sludge. In production version, a clamp will replace the series of bolts holding the cover.



Sludge, water, and other intruders collect in pockets off the perimeter of a spinning wheel simply because they are heavier than their carrier, the lubricating oil itself.

The purifier is not yet on the market. It will be. This article is an exclusive preview of a product that ultimately may revolutionize automobile-engine oil filtration.

From airplane to auto. The long test began with an inquiry to the Bergstrom Engineering Co., of Miami, in 1963. Bergstrom makes oil purifiers for airplane engines. From the start, the device—patented in 1957—was a runaway success in aircraft.

In 1962, one Bergstrom employee out of curiosity adapted one of the purifiers for his personal car and drove it more than 30,000 miles without changing oil. The engine still ran like a top.

The usual factory-recommended oil change interval these days is, of course, 6,000 miles.

POPULAR SCIENCE asked Bergstrom to fabricate two oil purifiers for automobiles, with suitable attaching hardware. It made a deal with the Dade County (Florida) Sheriff's Department to remove the conventional oil filters from a couple of police cars, put on the Bergstrom purifiers, and drive at least one of the cars 50,000 miles without an oil change. (The main test car was driven 49,949 miles, to be exact.)

For the purposes of this article, let's call the principal test car Test Car One, and the other Test Car Two. Test Car Two was a "backup" vehicle, for use if anything went wrong with One.

Finally, there was a "control" car, with a regular oil filter. Its oil would be changed at Plymouth's recommended interval of every 4,000 miles and its filter cartridge at every other oil change.

All three cars were 1964 Plymouth V-8 sedans, almost new.

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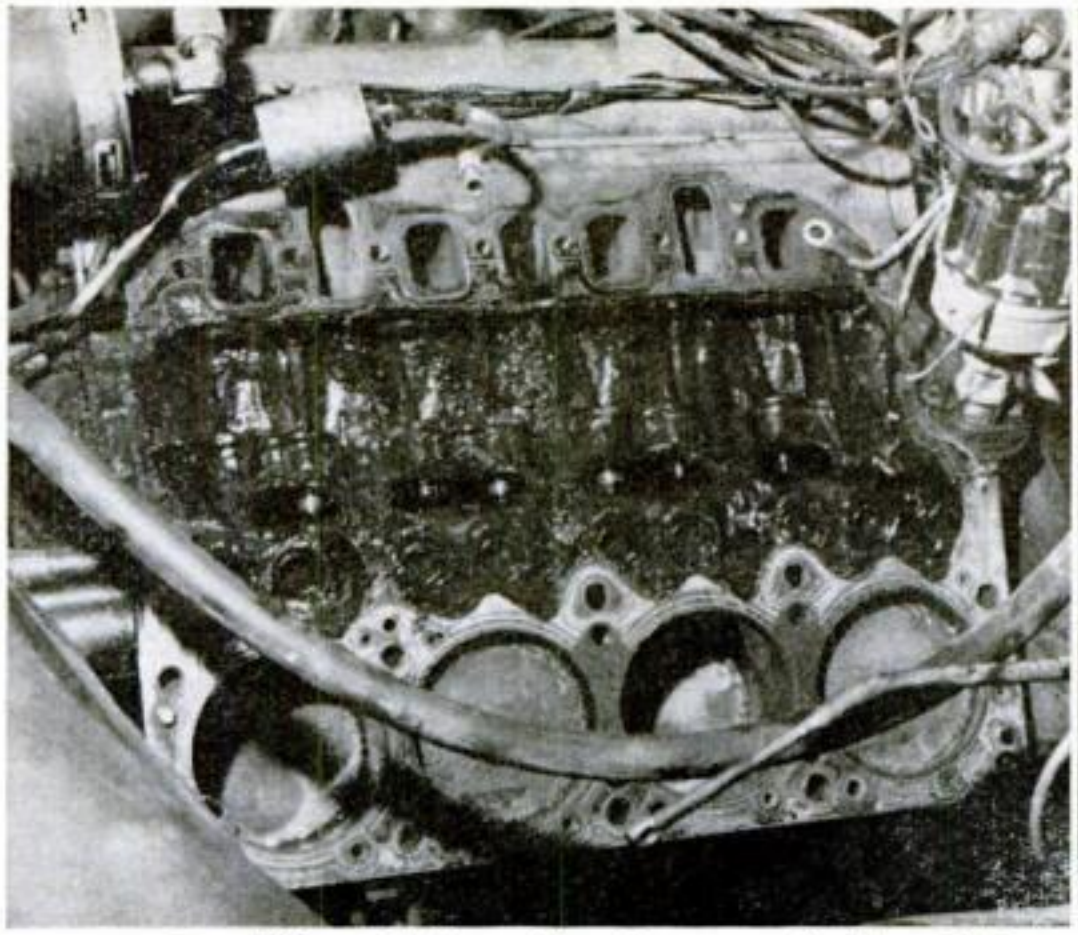
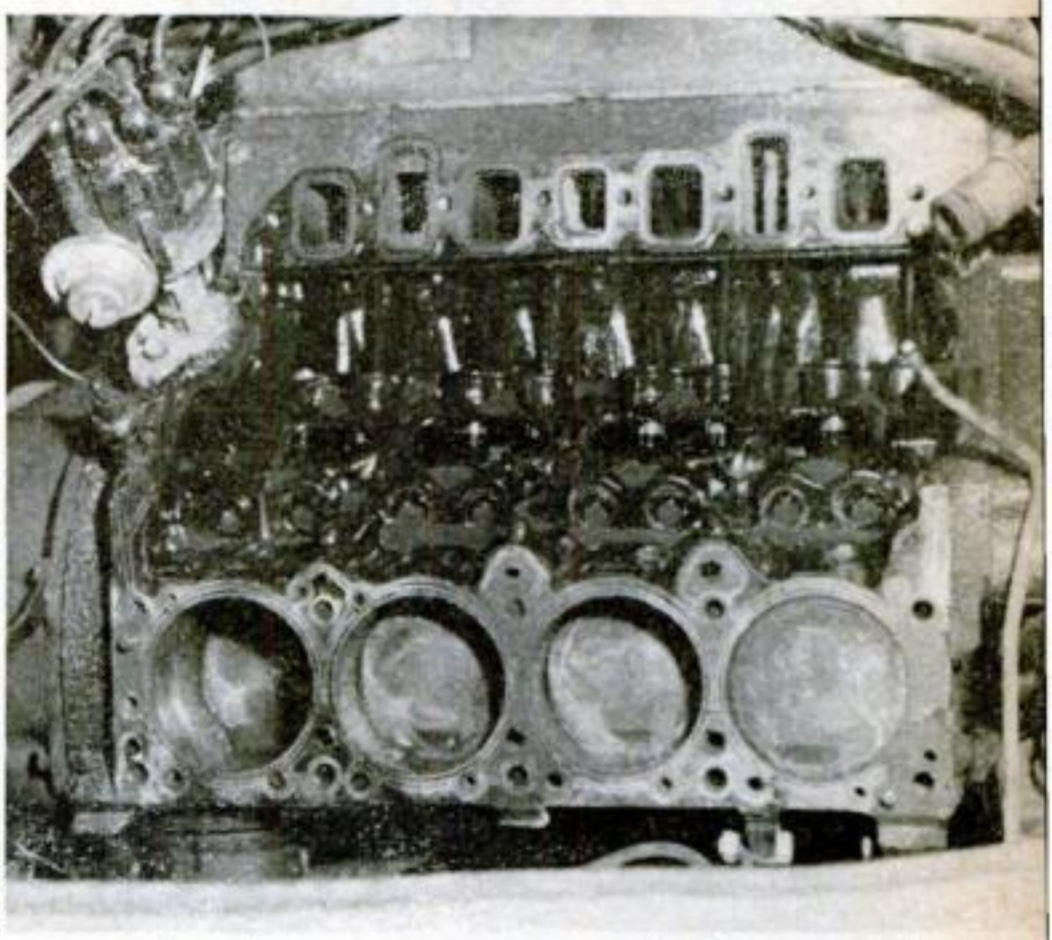
revolutionize standard automobile filtration systems



Condition of the valley between banks of Test Car One's cylinders is shown at end of 50,000-mile run when heads were removed and pans dropped. Muck found was fairly soft.



Control-car's engine interior, with advantage of regular oil and filter changes, was black and not sludge-free itself. In 52,651 miles, this engine used 43 quarts of oil, seven filters.

Test Car One was driven hard by deputy sheriffs on road patrol. Test Car Two was driven at high speeds for long distances. The control car received general usage.

This experiment was only a little less chancy than playing the slots at Las Vegas. A centrifuge that worked beautifully in an airplane was one thing. In a car it could be quite another.

Aircraft engines are run at constant speeds over long periods in relatively clean air. Automobile engines are subjected to stop-and-go driving, idling, only periodic high speeds, and the ingestion of heavy impurities from the air they breathe.

The POPULAR SCIENCE test was not the first to be run on a Bergstrom unit in a land vehicle. Some purifiers already were being used experimentally in a fleet of diesel trucks in Canada.

Bugs and problems. Shortly after the start of the test, bugs began to show up in the purifier on Test Car One. Bergstrom engineers had anticipated this because it was a breadboard, bench-made, device. First, a rotor shaft sheared. Then the seal on the rear cover began

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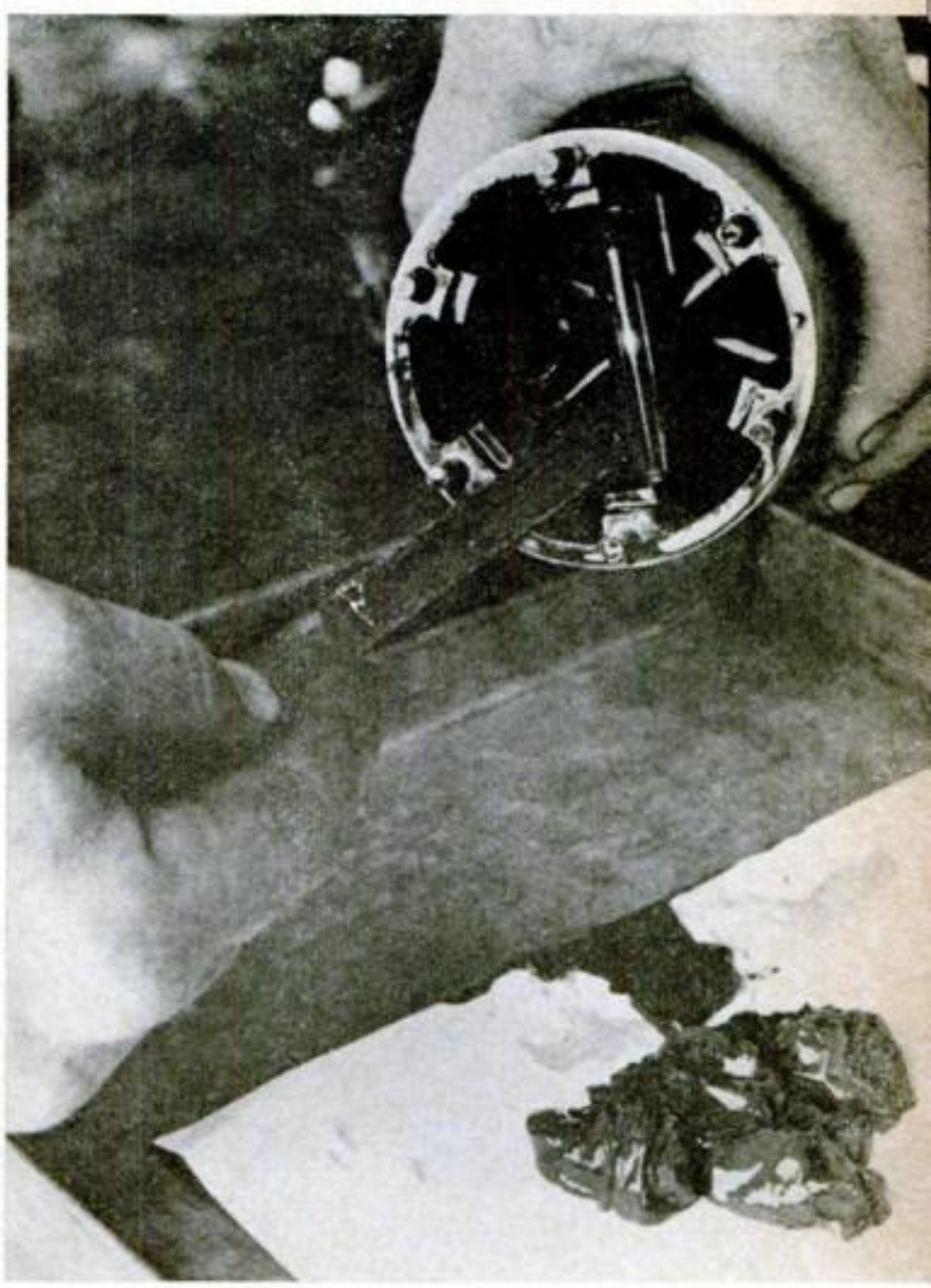

Sludge was scraped from Test Car One's rotor each 5,000 to 10,000 miles. It was gritty, coarse, and drier than that found in ordinary oil filter. Prototype purifier had sludge capacity of six cubic inches. This will be boosted to 16.

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One way to install a purifier is shown here on 1964 Chevrolet V-8. (Test cars were Plymouths.) Hose at rear draws oil—using regular oil pump—from engine sump into purifier. Hose from outlet on top of purifier returns it to engine system. The unit is belt-driven.

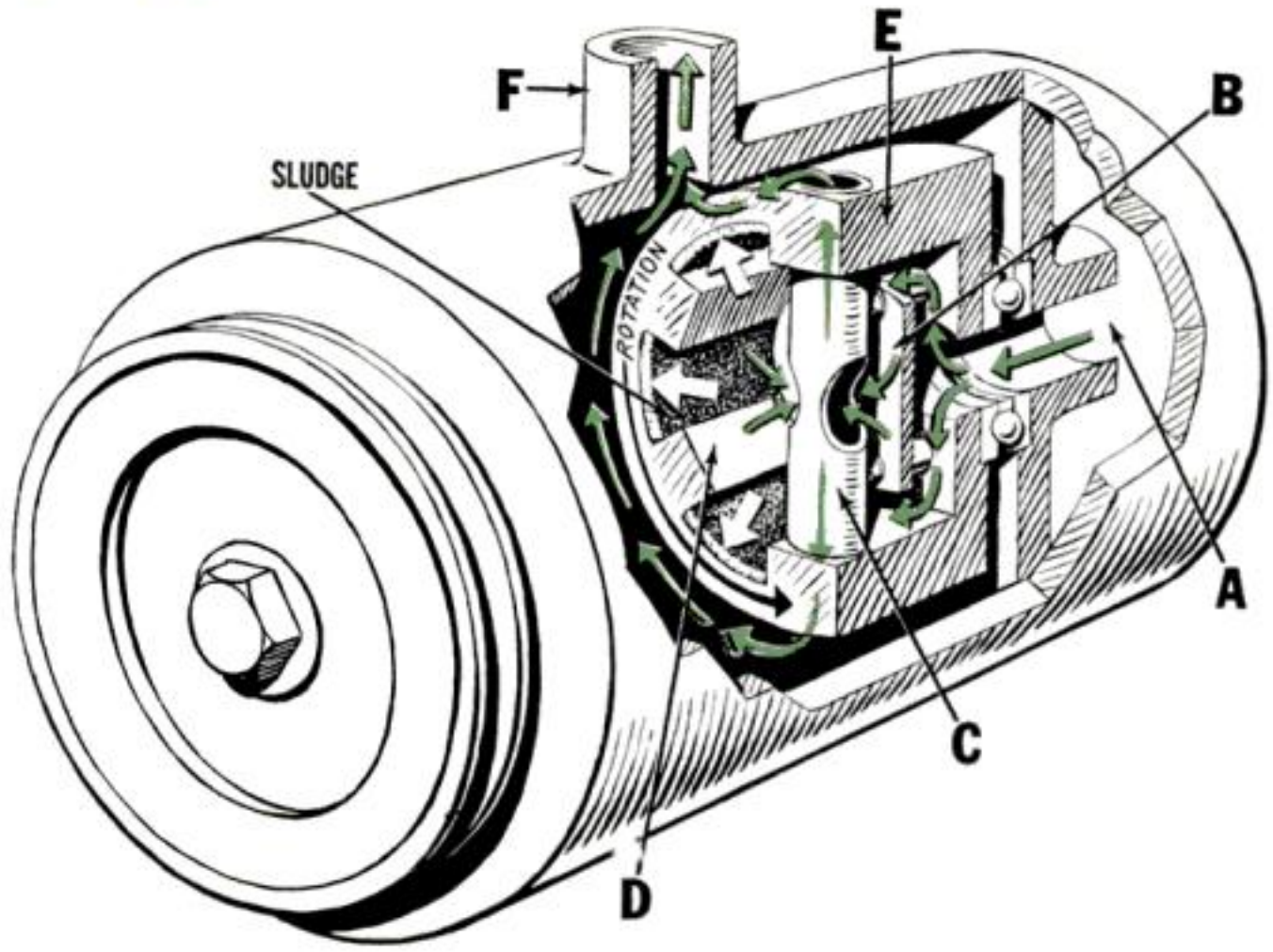
leaking oil. The engineers had to try several makes before they found an efficient seal.

All told, the purifier was off Test Car One for repair a total of about 10,000 miles. During this time, the oil in the

Installation on patrol car (above) of Dade County Sheriff T. A. Buchanan is checked by Bergstrom's Leslie Johnson, quality-control director; R. W. Bergstrom, president; and S. Y. Tao, chief engineer. At right, engineer R. K. Kirby explains unit's operation to Lt. Leo Portz of Sheriff's Department and Frank D'Azevedo of county Public Works.

Urheberrechtlich geschütztes Material

How the Filter Works



Centrifugal force created by rotation of purifier rotor (E) is represented here by white arrows; colored arrows show path of oil under pressure from engine oil pump. Oil enters port (A) and is baffled (B) to rotor's outer wall under centrifugal force (white arrows). There the sludge, heavier than the oil, collects between vanes (D). Oil pump forces cleaned oil (colored arrows) to center of rotor and into holes in "standpipes" (C), which conduct it to inner face of purifier's outer housing and thence through the oil return port (F) to the engine.

engine underwent no filtration at all.

In the early stages, the engineers cleaned the purifiers every 10,000 miles. But that of Test Car One sludged up much faster than that of Test Car Two. So the cleaning interval was cut to 5,000.

Present-day oils have special additives to combat rust, varnish, sludge, and corrosion. The oil used in the experiment was Super RPM Delo, SAE 30, produced by the Standard Oil Co. (Kentucky). Two of its principal additives had calcium and phosphorus bases.

Oil samples from the crankcase of Test Car One were laboratory-tested from time to time during the experiment. At 4,360 miles a New York laboratory, analyzing oil from Test Car One and new oil of the same grade and brand, reported that the unused oil had a calcium percentage of 0.096, and the used oil, 0.074. The respective percentages of phosphorus were 0.064 and 0.067.

The calcium and phosphorus percentages changed little in the oil of Test Car One during the remainder of the run. The additives may have played a major role in the results, as we will explain.

The acid build-up. Then there was the acidity. How many times has your filling-station man told you, "Better get an oil change—acid, you know"?

Laboratory tests showed that the acid did, indeed, build up in the Test Car One's oil—at 4,360 miles, more than eight times as much as is regarded by some oil engineers as acceptable.

That wasn't all. At 43,221 and 49,949 miles, Bergstrom itself had a laboratory analyze the oil from Test Car One. In both instances, the lab recommended that the oil be changed at 36,000 miles—the sludge index was prohibitive, and the viscosity too high.

At the conclusion of the experiment on Nov. 27, 1964, the heads of the three engines were pulled and the pans dropped. Here were the results:

- As the pictures accompanying this article testify, a considerable amount of sludge was found on valves, rocker arms, and in the crankcase of Test Car One.
- But the engine of Test Car Two (the backup) after 35,000 miles was cleaner not only than Test Car One but

[*Continued on page 210*]

"I'LL FLY

NASA pilot Milt Thompson, in an exclusive interview with PS's West Coast Editor, tells about his hair-raising flights for science

By Wesley S. Griswold

MILT THOMPSON has flown everything—with or without wings—from the fastest, highest-flying plane in the world, the X-15, to the most peculiar aerial contraptions ever built. Despite some hair-raising flight situations he has gotten into, he has always managed to walk away no matter how tough the landing. He has even been heard to say, "I'll fly anything!"

The 38-year-old test pilot for the National Aeronautics and Space Administration wasn't boasting; he's not the type. He was merely speaking with a quiet, half-joking confidence based on extraordinary experiences that, except for one, have turned out well—despite many anxious moments.

That exception took place on a bright windless morning in an F-104, one of the fastest operational U.S. military planes.

NASA Chief Research Pilot Joe Walker was scheduled

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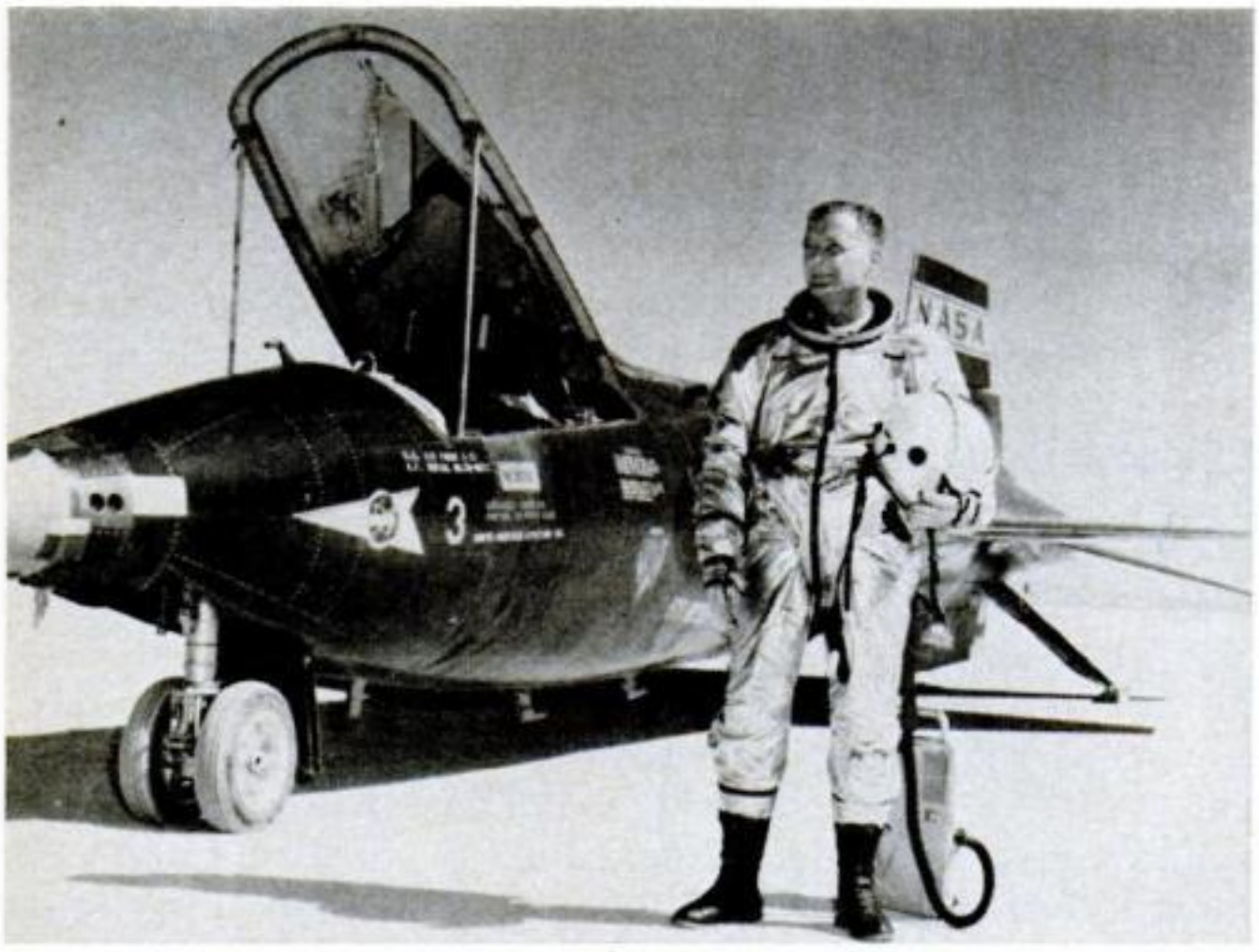

Milt Thompson has flown the X-15 (in background) as high as 93,000 feet, as fast as 3,500 m.p.h. He's also flown some of the zaniest-looking contraptions that have ever been built.

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ANYTHING!"

Here's Milt Thompson flying the Paresev—a job that's not for the faint-hearted. He's being towed to launch altitude of about 8,000 feet. The experimental craft—which is then cut loose from a bomber—drops one foot for every three it moves forward. Its typical flight path is a downward slant as steep as the slope of the meanest roller coaster. Paresev's average rate of descent is 4,000 feet per minute. Thompson says each Paresev flight seems like a long, fast slide to a probable crash, with doom averted at almost the last minute. In 60 flights, though, Thompson has had only one mishap, fortunately slight.

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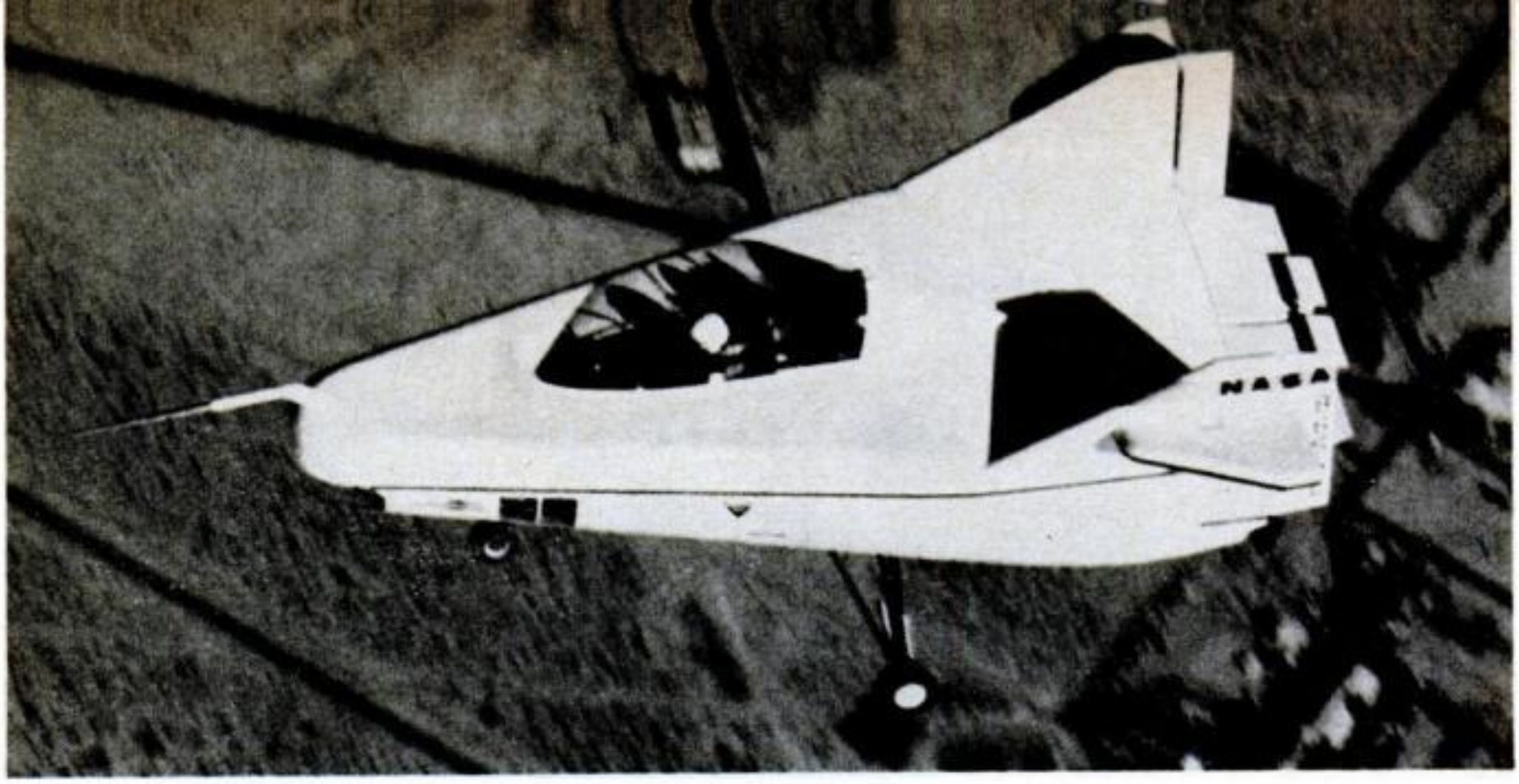


Some call it the Flying Bathtub, but the proper name for this wingless curiosity is the M-2 lifting body. Thompson is seen at the control stick while vehicle is being towed to launch altitude of 13,000 feet. He has flown it successfully 45 times, but says every flight in the "bathtub" seems like a potential accident. It rocks like a boat in a choppy lake when it hits wind gusts during descent. While he's falling in a 30-degree flight path, the pilot loses 4,000 feet of altitude per minute. Vehicle is a plywood prototype of re-entry vehicles intended to enable astronauts to pilot their way home from orbit through the atmosphere to a safe landing on the ground.

to make an altitude flight in an X-15. Thompson had gone out over the range in the F-104 well ahead of Walker's flight time to check on weather conditions. He came home with plenty of time and fuel left, and began shooting some simulated X-15 landings. He invariably does this for practice whenever he flies an F-104.

Thompson made one approach, simulated a landing, and climbed to make another. He began the second approach at 25,000 feet and 400 m.p.h. This time, the F-104 unexpectedly started rolling off. Thompson couldn't pull out of it. He added power and brought the air speed up to 450 m.p.h. By now he was just barely able to keep the wings level.

Call from the blue. "I called down to see if anybody had any good ideas on how I could get this thing straightened up and back on the ground," he said wryly.

Joe Walker answered the radio call and told Thompson he believed the trouble was that one flap had gone down and the others hadn't. That was the correct diagnosis, but the suggested cure didn't take. The situation even got worse.

"The plane went into an exaggerated roll," Thompson said later, "at the same time yawing and bending over toward the ground. I was down to 20,000 feet and had picked up another 50 or so miles of air speed. There was nothing to do but eject.

"Things happened pretty fast then. I was shot out of the airplane—upside down—and began falling through the air, taking a tremendous buffeting. I saw something flopping around in front of me—the seat. I still had hold of the ejection handle.

"It's pretty hard to let go of anything from 20,000 feet, but I knew I'd better, or the seat would foul the chute. So I let go, just before the chute automatically opened."

Most of the other aircraft Thompson has flown bear little resemblance to the F-104 or any other plane you've ever seen.

Take, for example, the Paresev—the Paraglider Research Vehicle. Thompson has made about 60 flights in this 640-pound aeronautical curiosity, after being towed to altitudes as high as 8,000 feet.

[*Continued on page 192*]

Urheberrechtlich geschütztes Material

Washington Monument gets big scrub-down

For the first time in 30 years the Washington Monument has been given a bath and thorough repair.

Water at high pressure through 500 feet of hose flushed the white marble face of the historic shaft. Then each block was repaired and scrubbed individually. The job took 4½ months. Low bid was $125,000.

Unlike the last time, when steel scaffolding was put up on all four sides, the work was done from moving platforms held by cable to top and sides.

To protect visitors from spray and falling loosened mortar, plywood enclosures were built around the base of the monument and its walkway.

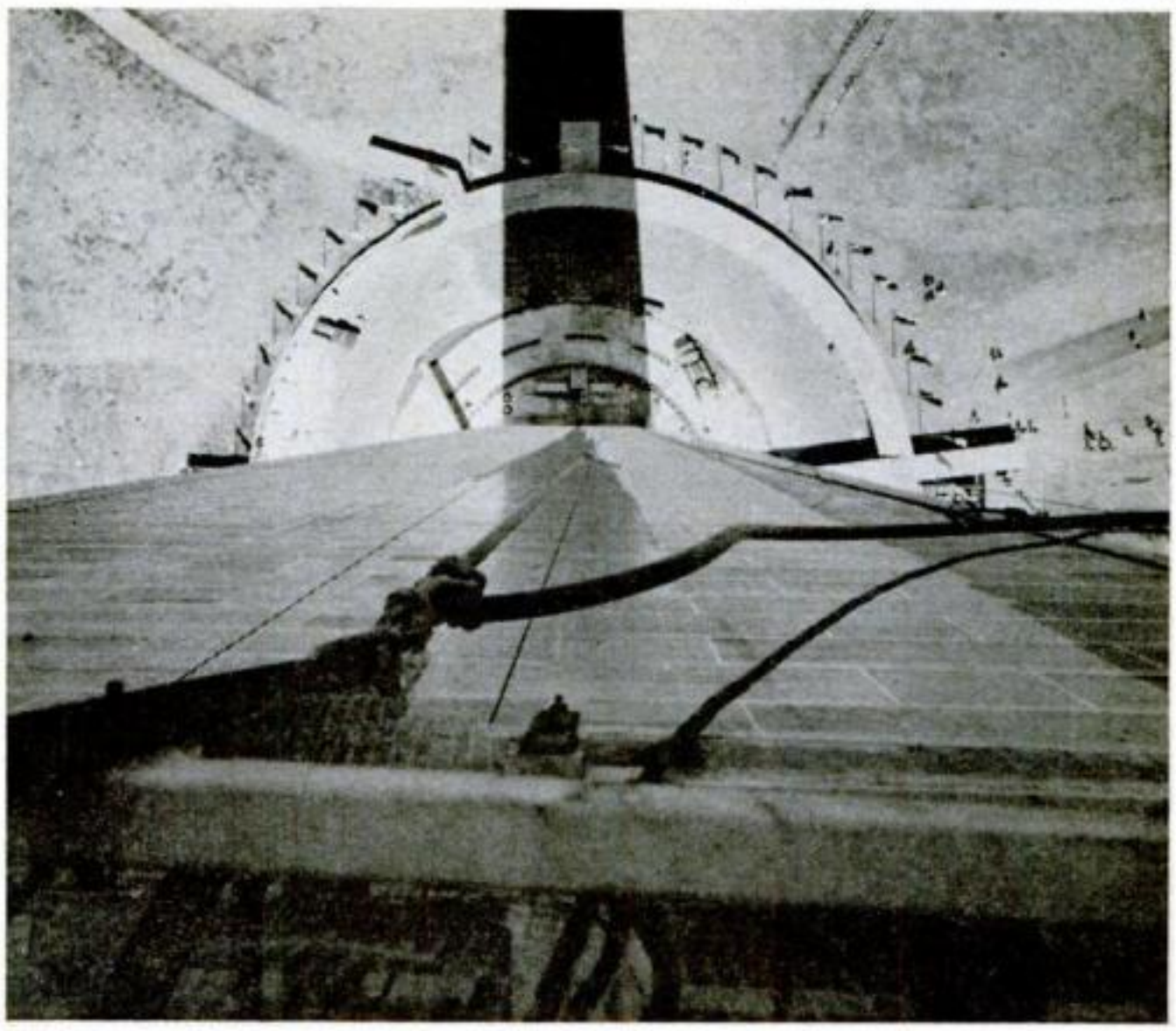
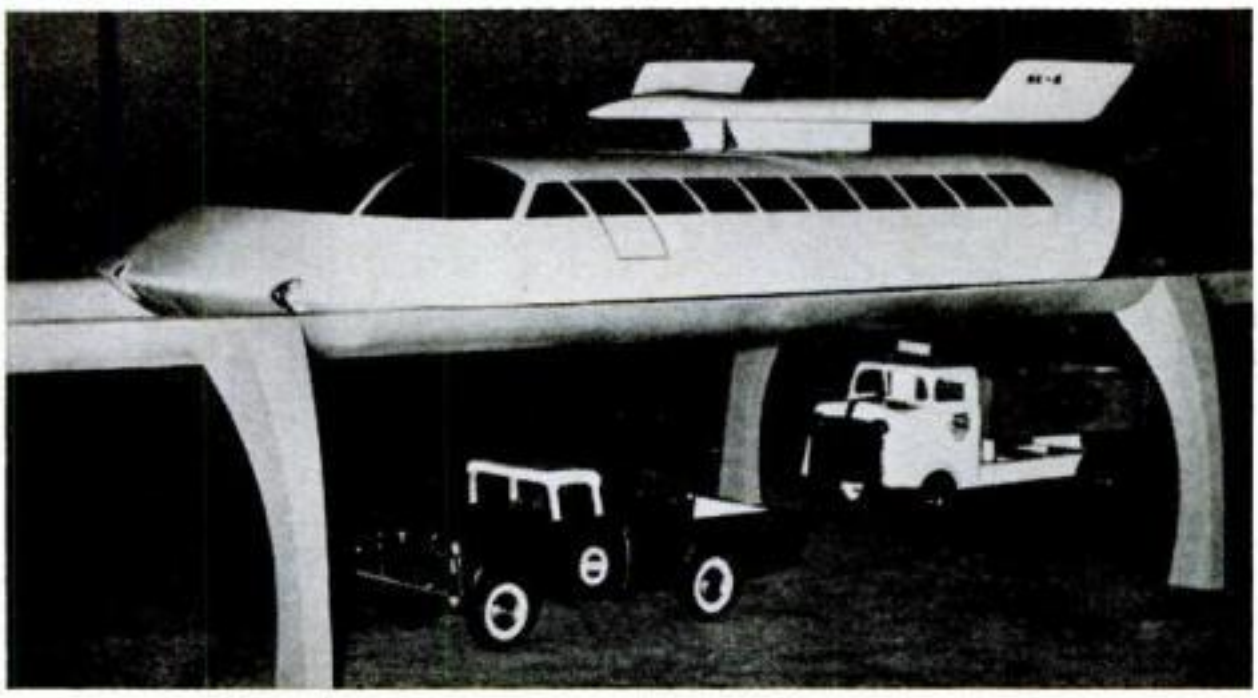


Photo taken from cleaners' scaffold makes monument appear wide at top.

Each marble block is repointed, repaired, and scrubbed (left). Plywood enclosures (right) protect public from spray and drilled out mortar.



Air-cushion monorail

A new rapid-transit car —cross between a plane and a monorail—has been designed in Zurich by Swiss architect Werner Muller. His Aerobus (model at left) rides on a cushion of air on a basin-like elevated structure above traffic. Wings on the roof add stability. Top speed is estimated by Muller at 250 miles per hour.

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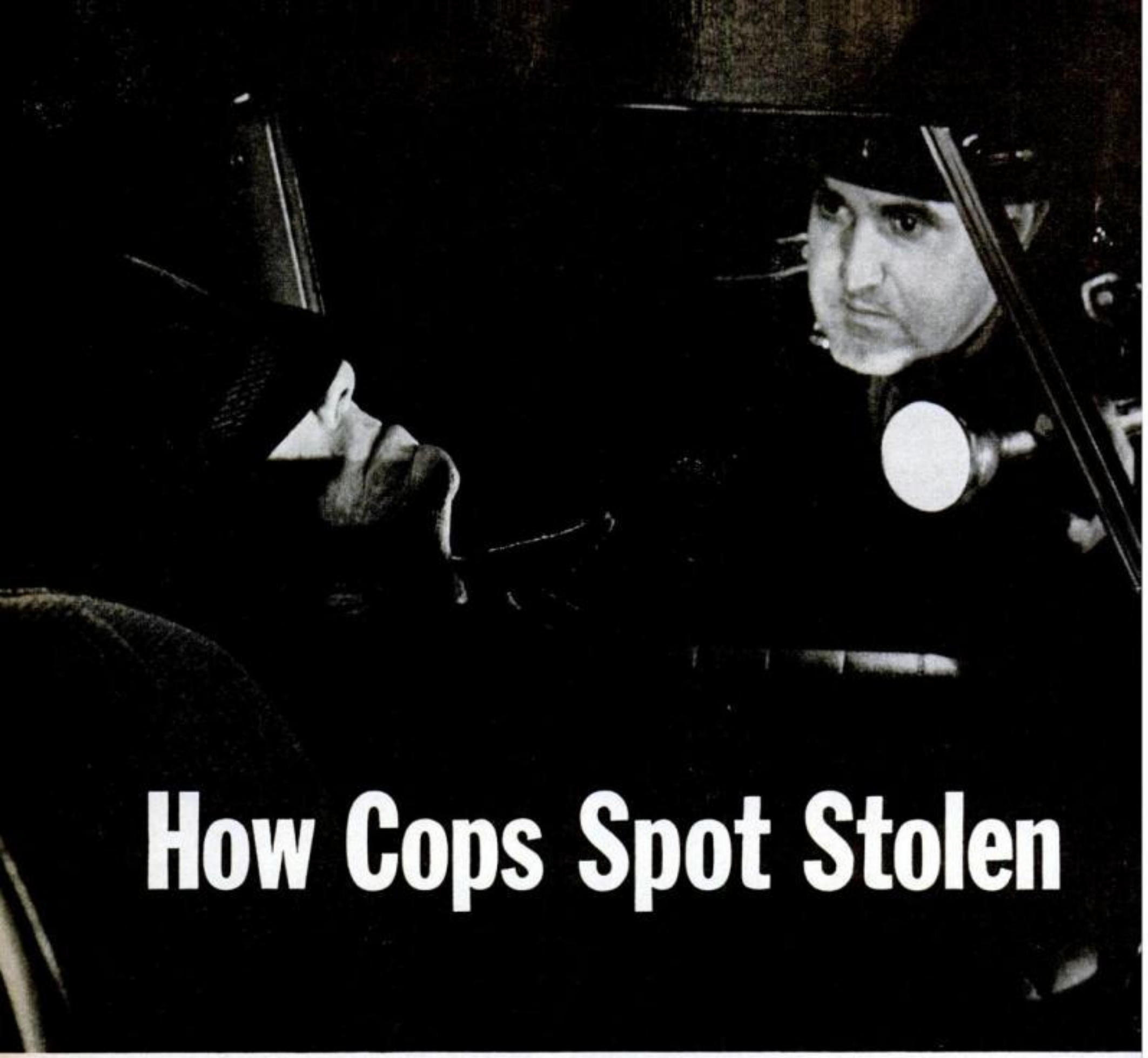

How Cops Spot Stolen

On the road, lacking funds, car thieves often hit the sack in the car, sleeping at odd hours

Thieves may be after your car—but if it's stolen, the odds are high that the police can bring it back, using tricks like these

MORE than 400,000 automobiles, including a police patrol car in Big Bear, Calif., were stolen in the U.S. during 1964. They disappeared from streets and driveways at the staggering rate of more than a thousand a day—almost one a minute.

A great many of the suddenly deprived owners had assisted the thieves by leaving their cars unlocked. Quite a few had even been obliging enough to leave the key inserted in the ignition.

However, if the end of the story of last year's appalling auto thievery remained consistent with that of previous years, nearly 90 percent of all those stolen cars have been recovered. True, most of them were damaged and some of them had been stripped of as much as $2,000 worth of parts. In consequence, once more your car-insurance premium climbed.

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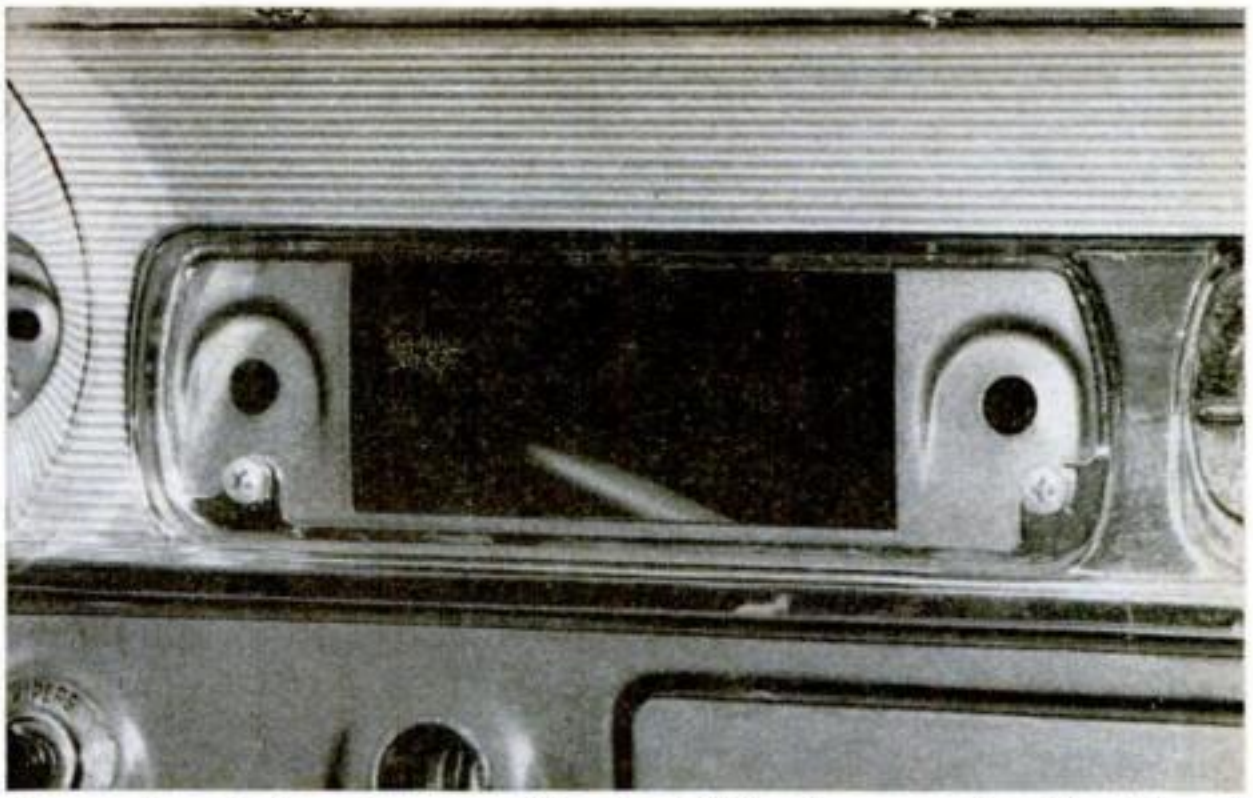
Urheberrechtlich geschütztes Material

Cars

in secluded spots.

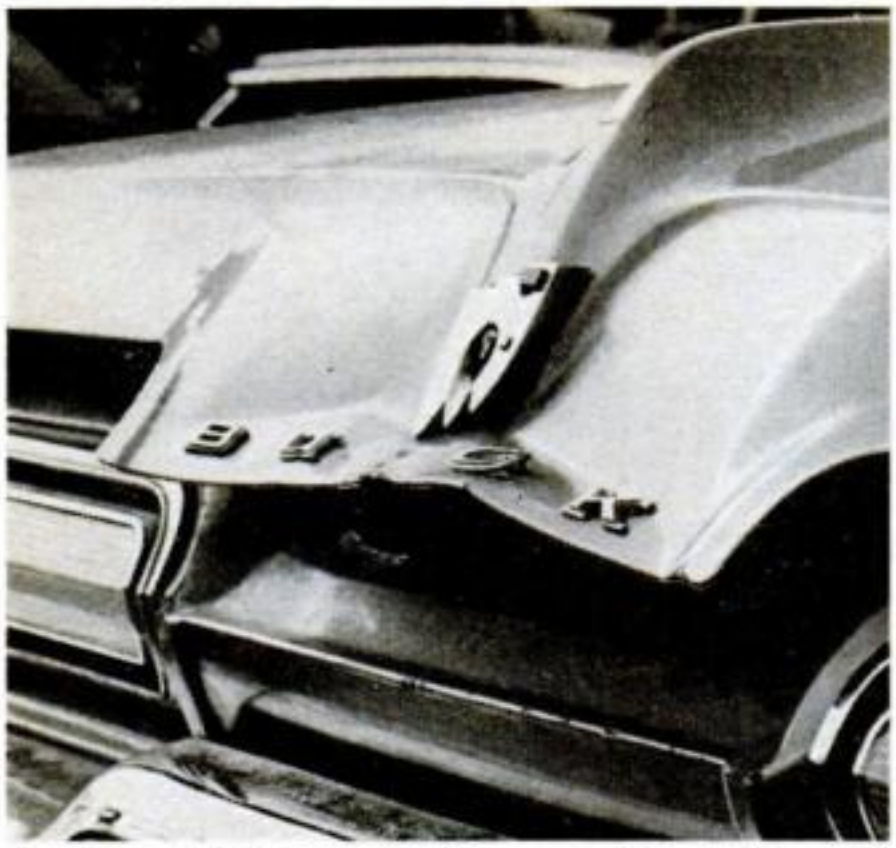


A yawning hole where a radio should be has occasionally alerted traffic officers about to ticket the driver of a late-model car for speeding. This lack, highly suspicious in a new vehicle, often means the driver has stolen the car and hocked the radio.

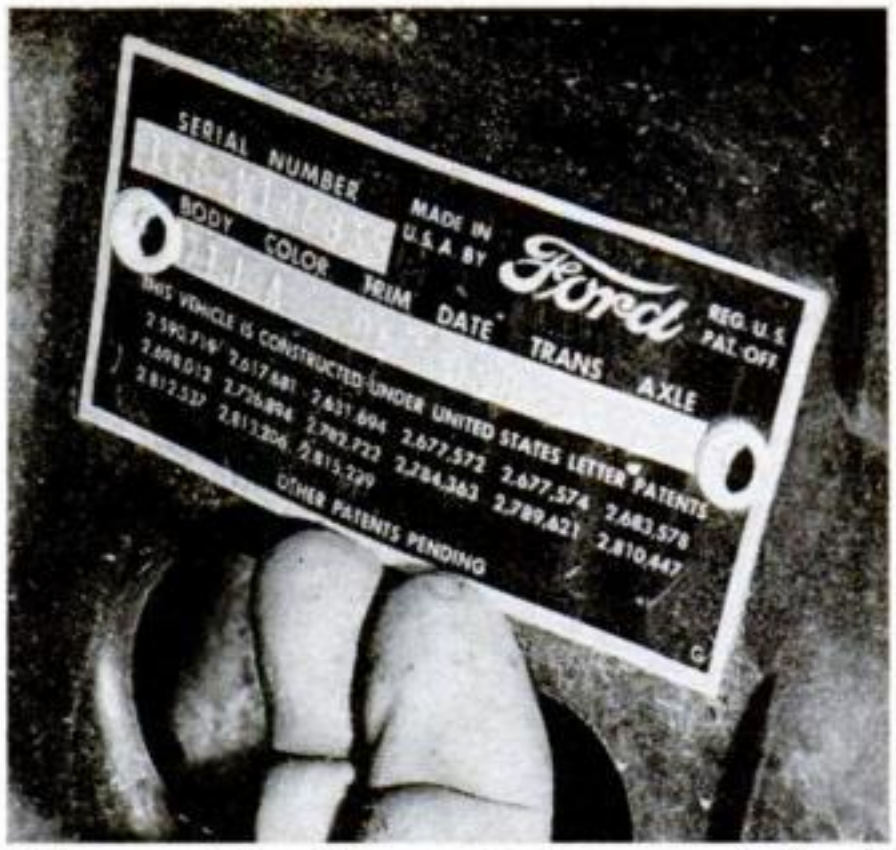
A broken wind vent, smashed close to the latch of the door, is another sign that may lead to the recovery of a stolen car. Thieves frequently use this means of forcibly entering a locked vehicle.

Wired-on license plates are often a cop's first clue to the possibility that the car bearing them has been stolen. The plates usually have been nabbed from still another car and hastily fastened to the stolen one in a crude effort to disguise its identity. Sometimes, holes in the trunk lid heighten suspicion, revealing that dealer's nameplate, evidence of the car's origin, has been removed.

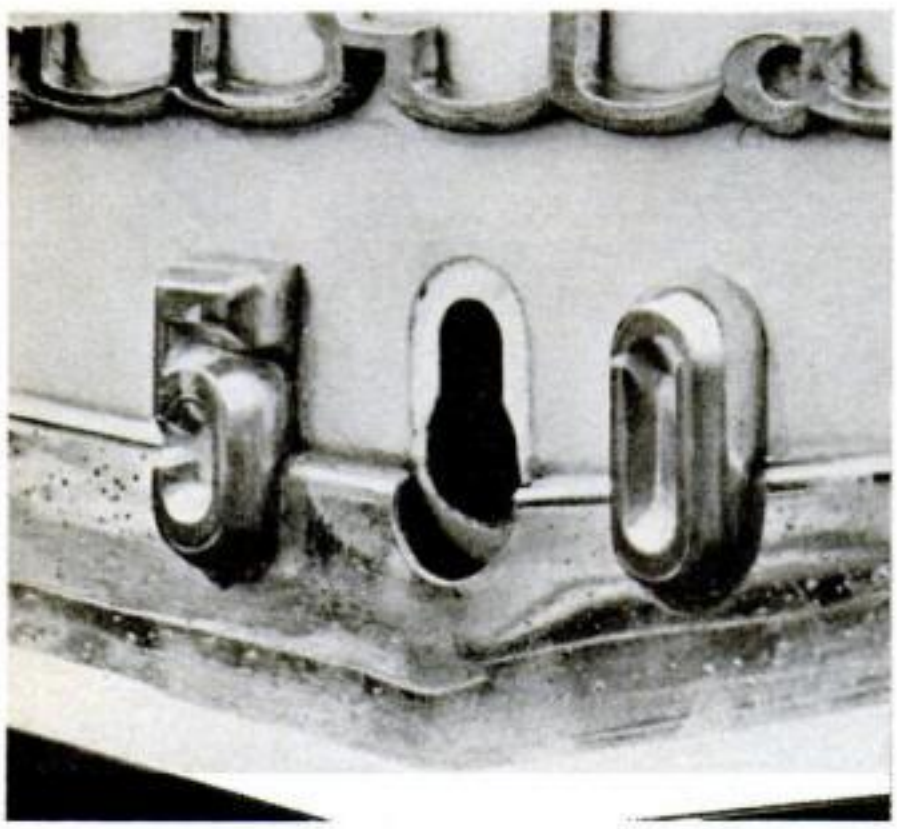
Urheberrechtlich geschütztes Material



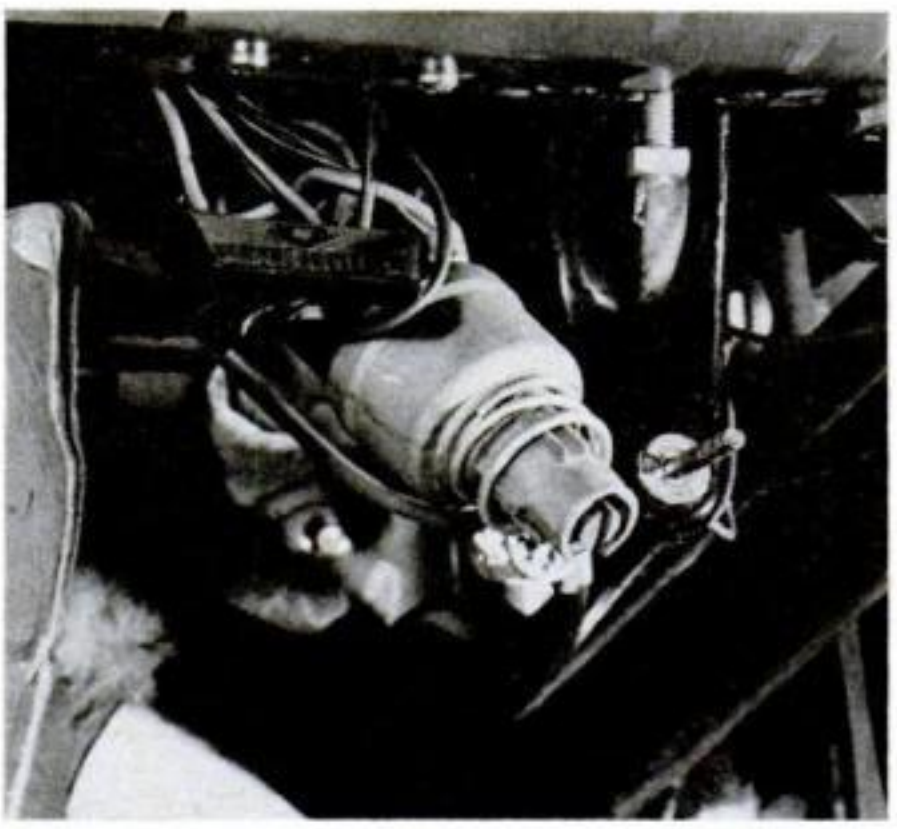
An inept thief or one desperate for quick cash will usually pry open the locked trunk of a car he has snatched, in order to sell the spare tire or other contents of value. Professionals seldom do anything so certain to draw the attention of the police to the fact that the car is stolen.



When suspicion is aroused that a car is "hot," a policeman usually tests the security of the identification plate on the inside of the left front door well. If spot-welded, it is almost certainly the car's own; if glued or soldered in place, it unquestionably came from some other car.



After making off with a car, a thief usually breaks into its trunk. If he's an old hand at stealing cars, he'll probably punch out the trunk lock, as was done here; this method of forcible entry is least likely to advertise itself to officers of the law on the watch for stolen cars.



"Hot wiring" enables a thief to start a car without an ignition key—a bit of evidence cops usually look for in vehicles they think have been stolen. Sometimes the thief has been caught red-handed with a hot-wired car merrily running and nary a key in the ignition lock.

Still, the fact that the police regularly recover such a high percentage of stolen vehicles is a striking tribute to their skill and perseverance. How do the cops spot stolen cars, anyway? Of course, they are given lists of the pertinent license numbers; but those lists are long and never quite up to date. Besides, they can't be checked against every passing or parked car.

Instead, policemen generally rely on certain telltale clues and their own trained powers of observation to detect vehicles that have been stolen. Sometimes they are rewarded by catching the thief at the wheel.

Some methods of detection are carefully guarded professional secrets. The most common clues they seek, however, are shown here.—*Wesley S. Griswold.*

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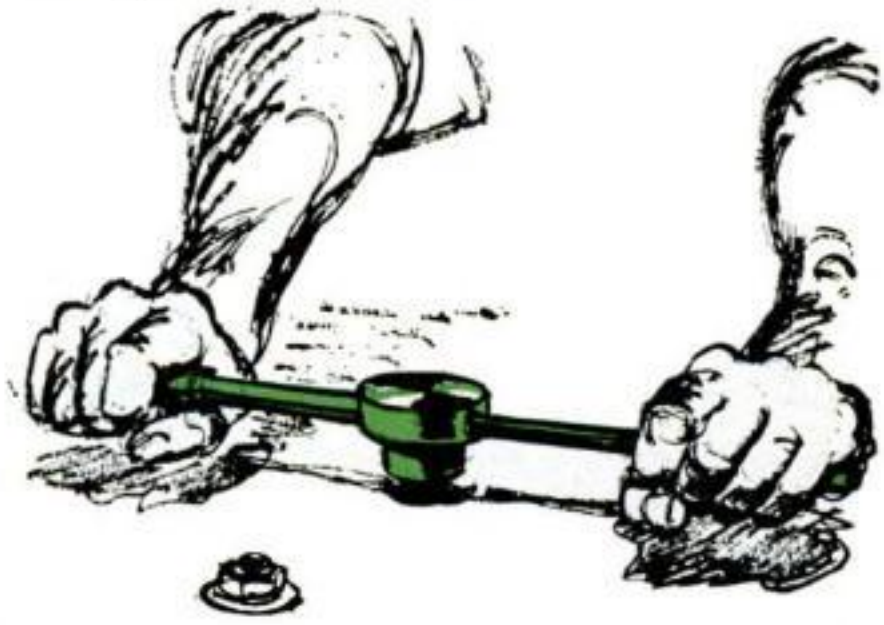
"I'd like to see them make..."

Tie-down cables for trailers—especially big, rarely moved house trailers. Stored in the roof or the sides on reels, they could be pulled out at once in a big blow.—*David Messersmith, Haysville, Kans.*

Pull-out extension cords built into electrical sockets. When not needed, the cord would disappear on a take-up reel and the socket would snap into place.—*Jim Gockley, Ephrata, Pa.*

Pop-open cans for movie reels. Why not make the metal tins like the old-fashioned shoe-polish cans with a built-in pry lever on the side?—*David Walberg, Des Plaines, Ill.*

A tile fixture to fit the corner of a shower stall and dispense liquid shampoo from the bottle. It would be inset in the tile like a soap dish.—*Robert Ham, Birmingham, Ala.*



A two-handled ratchet wrench with the second handle made to screw into the ratchet head. Present ratchet wrenches tend to pull to one side. —*Charles E. Tuma, Lombard, Ill.*

Everyone has his own pet idea of a gadget that he would like to see in general use. What's *yours?* We will pay $5 for each one published. Please use Government postcards only. Send to ILTS Editor, Popular Science, 355 Lexington **Ave., NYC 10017. Write your name and address clearly. Contributions cannot be acknowledged or returned.**

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Dry and unmoved, Rameses stares at activity around him. A 1,200-foot-long cofferdam (far background) keeps river at bay.

Camera-toting visitors thread daily between towering Rameses colossuses for one last view inside 3,200-year-old temples.

Moving day for Abu Simbel's temples—while tourists gawk

As history's greatest salvage operation goes on, awe-struck sightseers by the hundreds continue to flock for one last look at the temples of Abu Simbel on their 32-century-old site. The River Nile, now being backed up by Egypt's gigantic Aswan High Dam, will soon flood the spot.

First stage of the salvage is nearly complete: erection of a cofferdam around the base of the two temples—carved 200 feet into the rock cliff for Pharaoh Rameses II in 1250 B.C. The next stage, already started: digging out and sawing the temples and their facades into numbered sandstone blocks. The final stage will be reassembly on a plateau 225 feet above the present site. A UNESCO project participated in by 47 nations, the job employs 1,200 Swedish, Italian, German, French, and Egyptian workmen and engineers under the direction of an Egyptian. It involves moving 265,000 tons of rock—approximately the mass of the Empire State Building.

Meanwhile, tourists keep arriving by daily boat—to see both a marvel of antiquity and a modern engineering miracle.

Five-door Renault is sedan and station wagon

Out of France this spring comes the sedan-wagon. The Renault 16 has a top-hinged fastback tailgate and convertible rear seats that fold down to make a floor when carrying cargo instead of passengers. Its front seats tilt, too—all the way back to make a bed. In ordinary use, the vehicle is a front-drive, front-engine, four-door sedan. It's modeled on the 1500.

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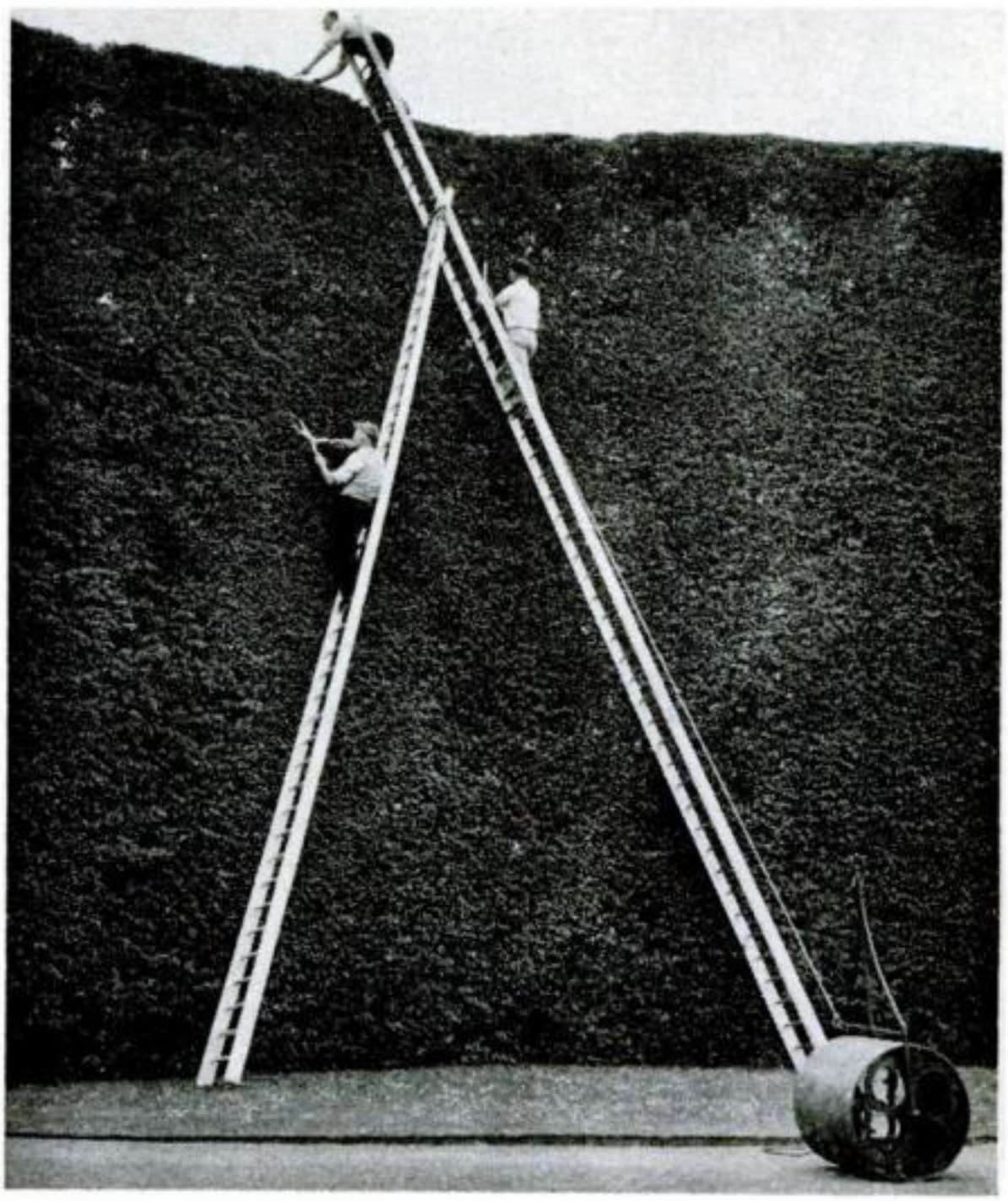
Trampoline goes to war as roof over bunkers

With a bow to popular playground equipment, Army engineers at Fort Belvoir, Va., are using trampolines successfully—not for GI bouncing, but for roofing bunker emplacements.

Made of nylon rope woven on a 14-foot-diameter steel ring, when topped by tarpaulin and covered with dirt, it takes 2,000 pounds' pressure per square inch.



Nice hedge-clipping job for British gardeners

After more than 200 years of growing, the yew hedge surrounding Oakley Hall near Cirencester, England makes a formidable green wall. Planted in 1720 by the first Earl of Bathurst, it's now 36 feet high. It's hand-trimmed by a crew of three men on a special ladder. They take 10 days to do the job, then start all over again.

Sculptor of figureheads updates an ancient art

A salty old profession has been given a new twist by a young Los Angeles sculptor-sailor. Tom Holland, who lives on his 38-foot sloop, molds scaled-down figureheads of fiberglass to fit prows of small sailing vessels.

To these he can add facial features, hair, and dress to reproduce a customer's wife or best girl. He carves figureheads of walnut and other hardwood, too.

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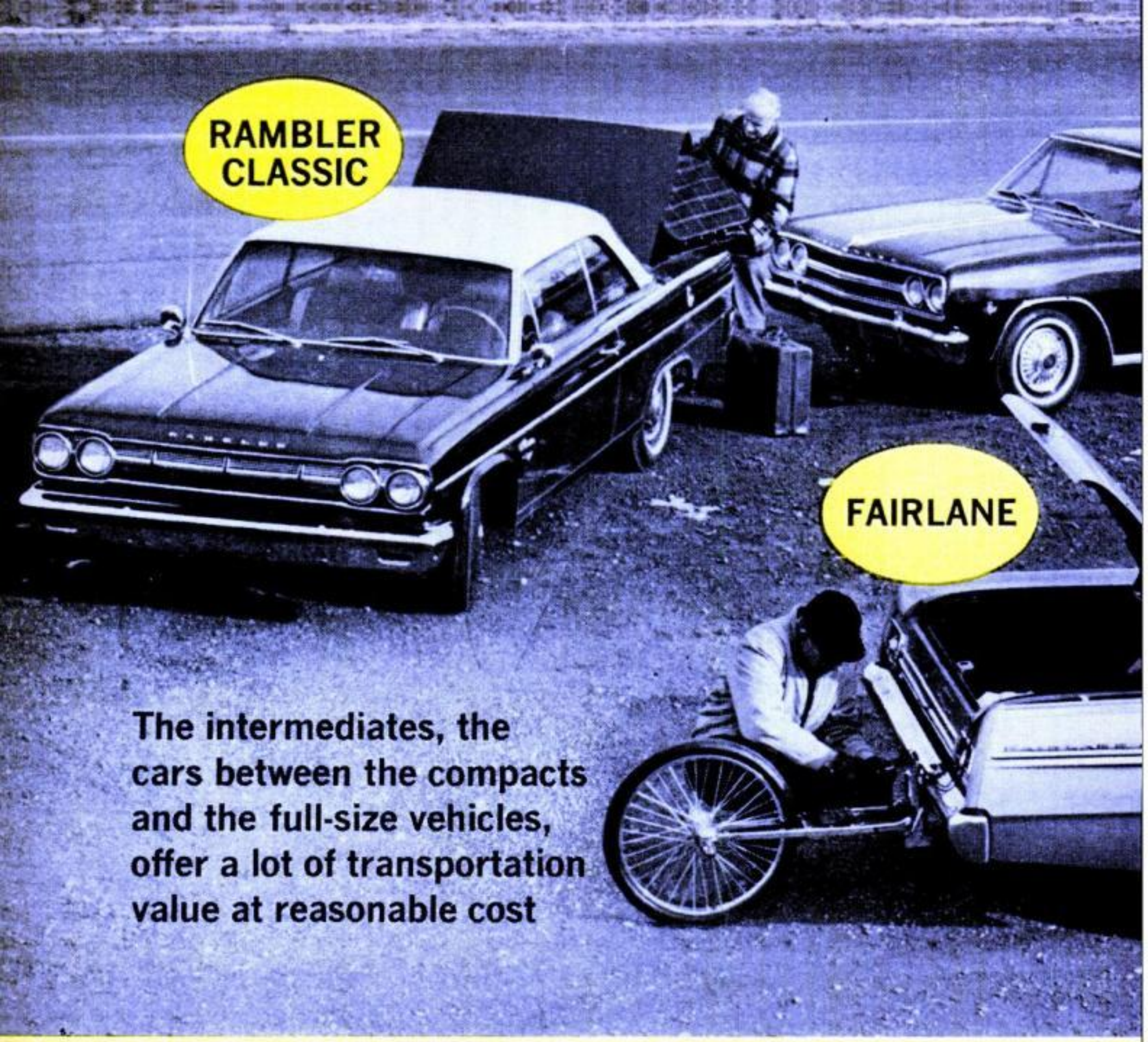
RAMBLER CLASSIC
FAIRLANE
The intermediates, the cars between the compacts and the full-size vehicles, offer a lot of transportation value at reasonable cost

REPORT FROM THE DRIVER'S SEAT

Test-Driving

By Jim Whipple

ONE of those middle-aged engineers with a jaundiced eye, who has watched Detroit make its mistakes for two decades, brightened up considerably the other day when he got to talking about the '65 crop of intermediate-size cars.

"Even standing still in the street," he said, "they're superior to the automobiles of the same dimensions 10 years ago."

He meant that the group of vehicles represented by Chevy Chevelle, Dodge Coronet, Rambler Classic, and Ford Fairlane were easier to get into and out of. They have more leg room. They have reduced the space occupied by propulsive machinery to the lowest common denominator.

He meant more, too. These cars, about the size of the "big" Chevrolets,

Urheberrechtlich geschütztes Material

the Intermediates

Fords, Plymouths, and Dodges of 1955-57, are quieter-running. They have almost no squeals and rattles. They ride more smoothly. They have as much stability at 80 miles an hour as their forebears had at 65. They handle better.

Today's intermediates, let's add quickly, are not paragons of all the mechanical virtues. They have faults.

Now, on to the cars. We tested four of the intermediates: one from each of the four big manufacturers—GM, Chrysler Corp., Ford Motor, and American Motors.

The intermediate-size group actually is pretty big. It includes, in addition to the four just named, the Pontiac Tempest, Olds F-85, Buick Special, Plymouth Belvedere, and (if you'll stretch a point on dimensions and performance) the Mercury Comet.

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Urheberrechtlich geschütztes Material

CHEVELLE has a suspension that's fairly soft. It tends to make car lean in the corners and wallow just a bit on rough country roads.

FAIRLANE is stable and rock-solid at high speed, handles well. On rough going it has little body shake and almost no vibration.

CORONET proved to have the best combination of ride and handling among the four cars. It has a slightly longer wheelbase, is heavier.

CLASSIC is steady and comfortable on good roads. A shorter wheelbase, advantageous in maneuvering, poses problems on winding roads.

All four of the cars tested have V-8 engines and automatic transmissions. They are priced (before delivery charges, state and local taxes, or extra-cost accessories) at around $2,700, give or take $50.

Our tests were not on perfectly matched items. The Chevelle, for instance, was equipped with an extra-cost, premium-fuel, 327-cu.-in. engine instead of the standard 283-incher. We also drew a slightly larger V-8 of 318 inches on our Dodge Coronet, which normally carries one of 273 inches.

We chose the Coronet instead of the Plymouth Belvedere because it is a new entry in the field, with reductions in wheelbase, weight, and length. For '65, Dodge shortened this series from a wheelbase of 119 to 117, a one-inch margin over Plymouth.

Finally, this year Rambler reshuffled its lineup so that the 112-inch-wheelbase Classic (195 inches overall) matches its opposite-number intermediates in price and performance better than the company's Ambassador.

As we start on our comparison test, our four intermediates look a good deal alike. All have dual headlights in horizontal pairs separated by wide grilles, crisp contours, and, with slight variations, the popular slab-sided look.

First, the Chevelle. Its performance was great, thanks to the 250 lively horses given their rein each time I opened the four barrels of the carburetor. The power of this extra-cost V-8 tends to counterbalance the inefficiency of the Chevelle's Powerglide automatic transmission. It has only a D (for Drive) and an L (for Low) in forward ratios. There is no middle gear. With either the 120- or 140-hp. sixes, the Chevelle's performance suffers for lack of another gear.

Of the four cars tested, the Chevelle is the only one with a conventional separate body and frame. The other three are unit construction—body and frame are one.

The two types of construction involve different principles of sound and vibra-

Urheberrechtlich geschütztes Material

CHEVELLE would be a bit easier to drive if its steering wheel were tilted at more of an angle from horizontal, moved forward an inch or so.

CORONET also has good driving position and steering-wheel location. Headroom proved the best. Car also has best instrumentation.

FAIRLANE has better steering-wheel placement, with wheel well forward, and a steering column angled to give knee clearance.

CLASSIC has good forward vision and comfortable seats, but the wheel is too low and too close to driver to permit a proper arm angle.

tion elimination. The Chevelle's body is insulated from the frame by large rubber washers that block off vibration from the suspension to the frame.

In the other three cars, the unit structure is so rigid that small-scale vibrations are absorbed by sound-deadening materials strategically placed throughout the body; or such resonances are played against each other by design of the parts and are tuned out.

Whatever the virtues of the two kinds of construction, the Chevelle's body seems to take on a rubbery shuddering when the car is driven over rough roads.

By contrast, the bodies of the three

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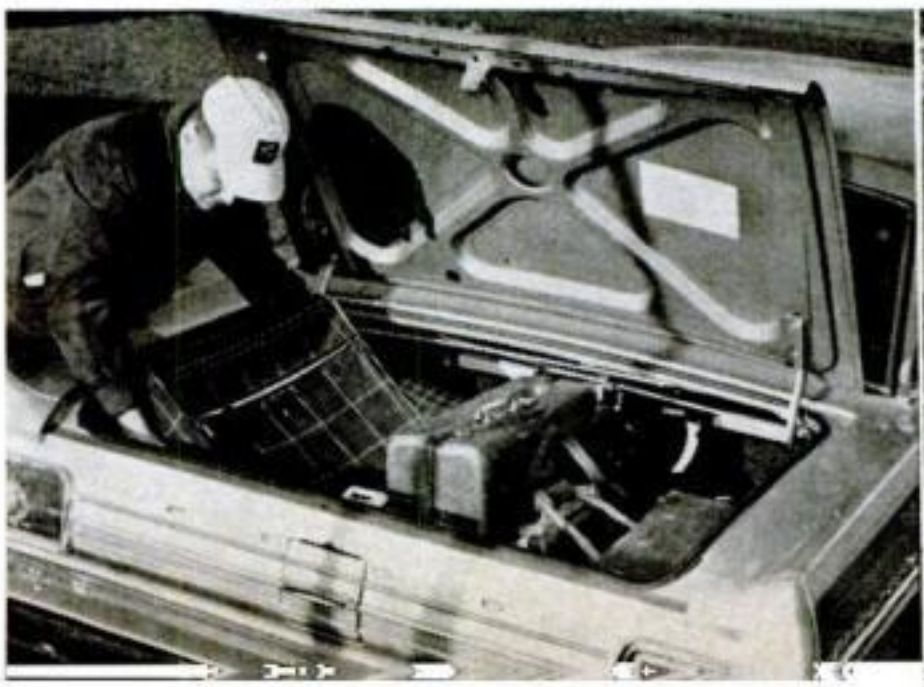
FAIRLANE has a roomy trunk, but of the four cars, it was least accessible, with a high sill and small lid. Luggage must be lifted higher.



CLASSIC has the easiest-to-load of all four luggage compartments, with the lowest sill and the gasoline filler located at body side.

unit-construction cars (Fairlane, Dodge Coronet, Rambler Classic) are rock-solid. They have no structural shake. Some mild drumming can occur on rough pavement, but it's pretty well deadened.

The Chevelle also has a tendency to lean on turns, and on certain types of undulating back-country roads it tends to wallow. The power steering is quick and accurate, but more road feel would be welcome. The brakes are adequate, and balanced for smooth, straight-line stopping, but there isn't much resistance to fade after a few successive stops from high speed.

The Fairlane. Ford's intermediate handles exceedingly well. There's little lean on hard turns, and the steering action with power is accurate, with no hint of sloppiness or wander. It goes where you point it, and that's true even on cambered, hump-backed roads.

The power steering doesn't give as much assist as the Chevelle's, which leaves the driver with a feeling that he controls the machinery, not vice versa. The Fairlane's transmission is quiet, smooth, and provides a good boot in the pants for passing.

Despite the larger Coronet engine, the

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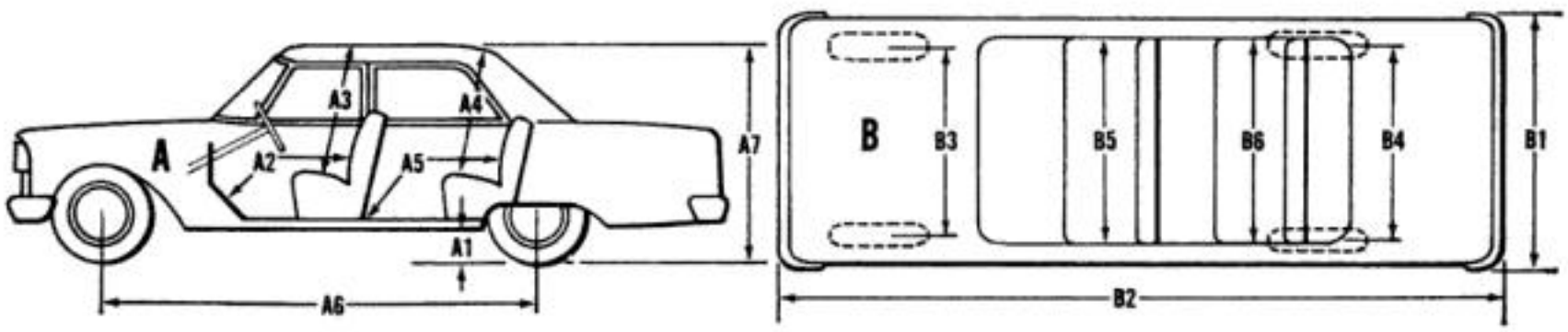

	CHEVELLE Malibu	FAIRLANE 500	DODGE Coronet	RAMBLER Classic 770
DIMENSIONS (inches)				
A1 Ground clearance	4.7	5.8	6.1	6.0
A2 Front legroom	42.0	42.2	41.9	41.0
A3 Front headroom	38.6	38.5	39.9	38.8
A4 Rear headroom	37.3	37.5	39.2	37.0
A5 Rear legroom	36.3	37.5	36.6	37.6
A6 Wheelbase	115.0	116.0	117.0	112.0
A7 Overall height	53.2	55.8	55.8	54.4
B1 Overall width	74.6	73.8	75.6	74.5
B2 Overall length	196.6	198.4	204.3	195.0
B3 Front tread	58.0	57.0	59.5	58.2
B4 Rear tread	58.0	56.0	58.5	57.3
B5 Front-seat width	59.9	58.4	60.8	60.2
B6 Rear-seat width	59.8	58.6	61.0	60.1
SPECIFICATIONS				
Engine type	OHV V-8	OHV V-8	OHV V-8	OHV V-8
Bore & stroke	4.0 x 3.25	4.00 x 2.87	3.91 x 3.31	3.75 x 3.25
Displacement	327 cu. in.	289 cu. in.	318 cu. in.	287 cu. in.
Compression ratio	10.5:1	9.3:1	9.0:1	8.7:1
Carburetion	1 4-bbl.	1 2-bbl.	1 2-bbl.	1 2-bbl.
Fuel grade	Premium	Regular	Regular	Regular
Horsepower	250 @ 4,400	195 @ 4,400	230 @ 4,400	198 @ 4,700
Torque (lb./ft.)	350 @ 2,800	282 @ 2,400	340 @ 2,400	280 @ 2,600
Transmission	Powerglide 2-speed & torque converter	Cruise-O-Matic 3-speed & torque converter	TorqueFlite 3-speed & torque converter	Flash-O-Matic 3-speed & torque converter
Axle ratio (std.)	3.07:1	2.80:1	2.76:1	3.15:1
Steering ratio—manual	28:1	27.8:1	28.7:1	28.3:1
Steering ratio—power	20.4:1	20.0:1	18.8:1	20.8:1
Brake-lining area (effective)	168.9	154.2	195.2	167.5
Curb weight	3,240	3,155	3,320	3,261
Price at factory*	$2,645	$2,642	$2,702	$2,722
PERFORMANCE				
0-60 m.p.h.	8.4 sec.	9.9 sec.	10.7 sec.	12.1 sec.
0-80 m.p.h.	16.9	20.2	22.3	24.7
40-60 m.p.h.	4.5	6.1	6.1	6.8
50-70 m.p.h.	5.5	7.2	8.2	8.7
SS ¼-mile	16.2	17.1	17.9	18.3
Overall fuel mileage	14.7 m.p.g.	16.9 m.p.g.	18.5 m.p.g.	18.1 m.p.g.

***Price for top-line 4-door sedan includes federal tax, automatic transmission, and dealer preparation.**

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Putting a Library in a Shoe Box

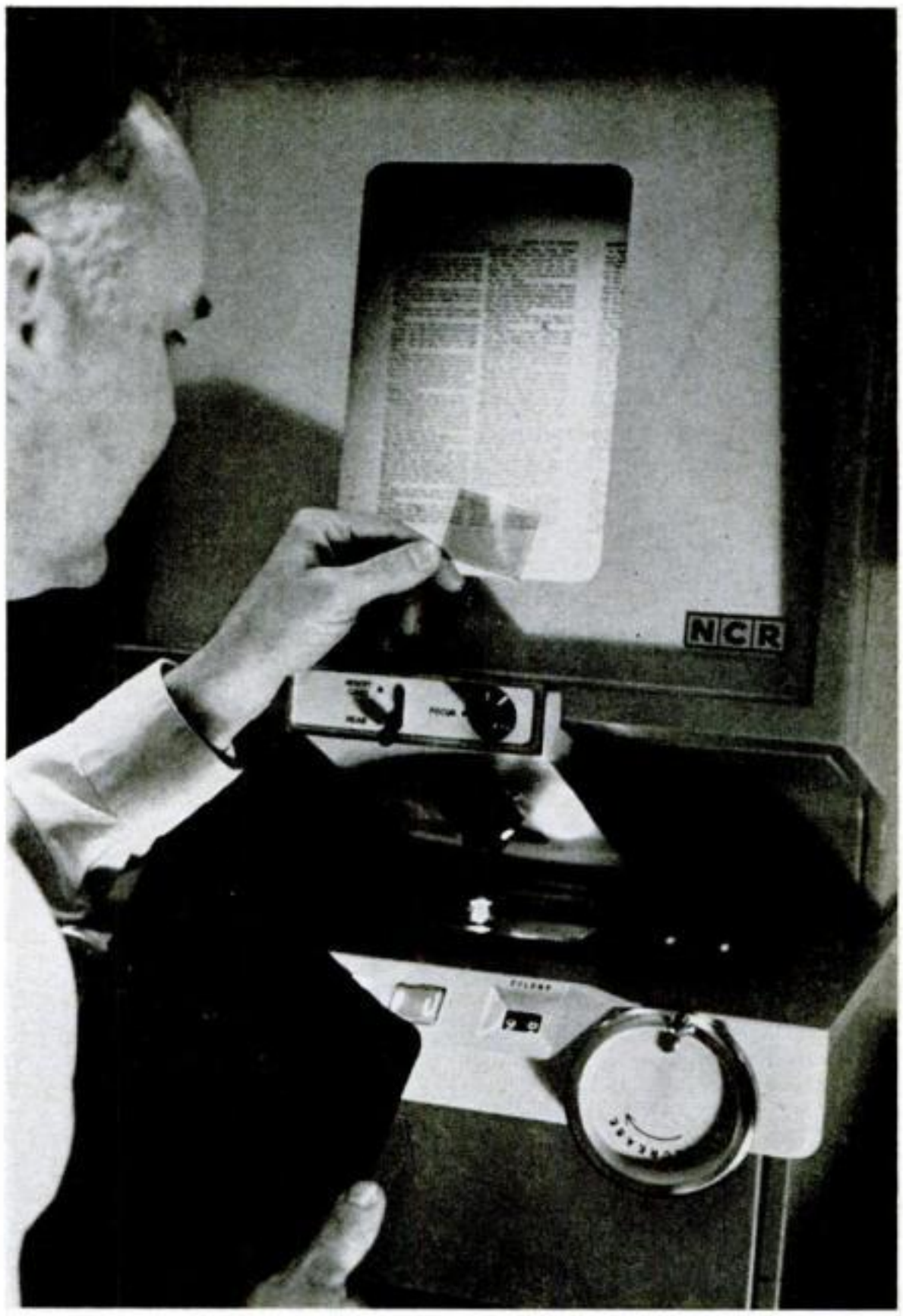
HOW would you like to have the Library of Congress, occupying 270 miles of bookshelves, in your house?

Sounds impossible? Well through a new microphotography process, PCMI (photochromic micro-images) you may, one day, be able to have the entire contents of the great library in your den on film—all contained in about six standard filing cabinets. A viewer is already available to project the filmed images.

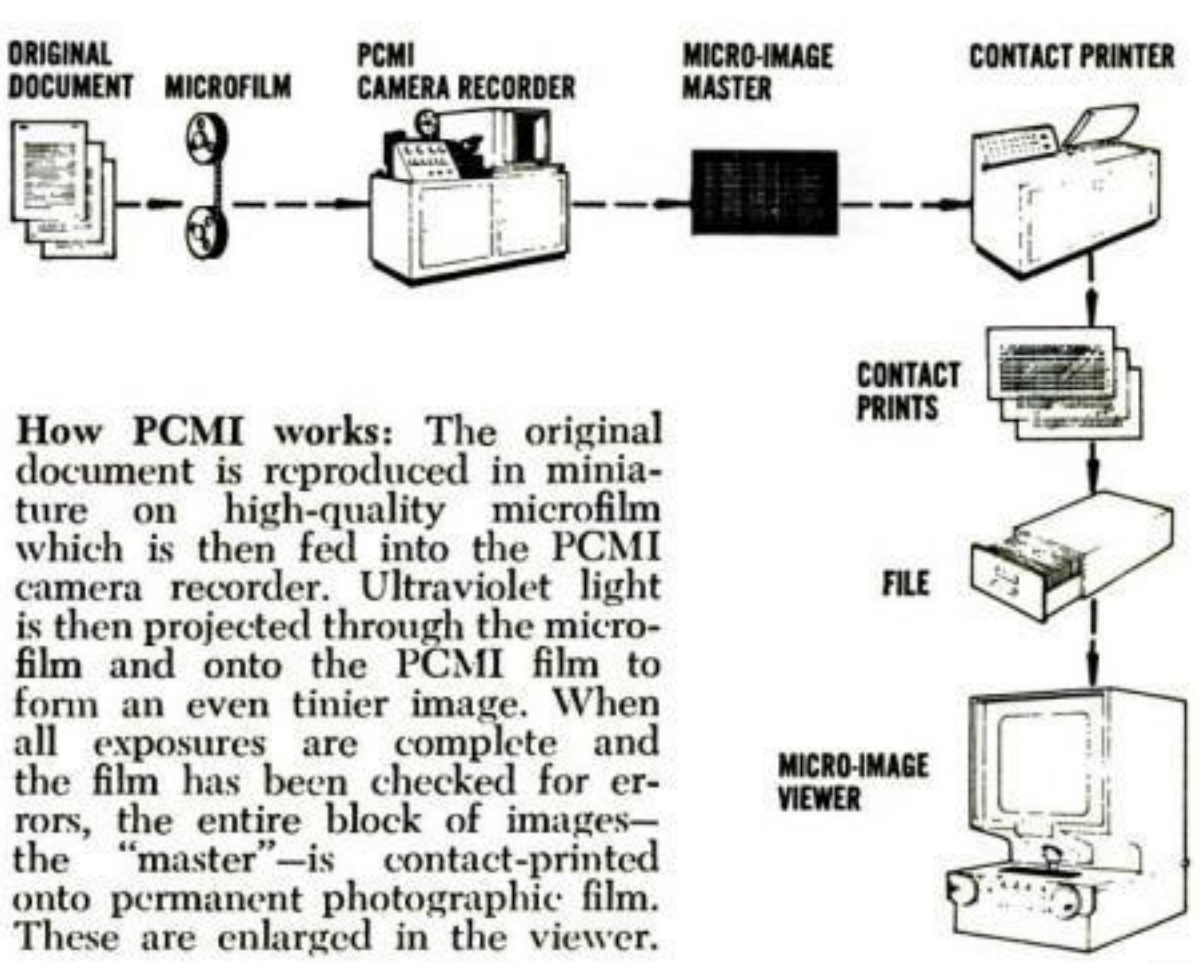
The National Cash Register Co. has rung up this microphotography marvel that makes ordinary microfilming look gigantic. NCR's micro-images are 1/120 the size of microfilm images and allow the company to achieve feats such as reproducing the entire Old and New Testaments —1,240 pages—on a single sheet of 2″-by-2″ plastic film.

The micro-images are made on a unique film coated with organic dyes that respond to ultraviolet light. PCMI photos are grainless and have excellent gray-scale characteristics.

No developing is necessary; the image appears immediately after exposure. Best of all, the process allows mistakes to be erased with a flash of yellow light and you can re-expose the same film. A permanent image is obtained by contact printing on conventional film.



Amazing photo miniaturization reduces the entire Old and New Testaments to a single 2″ plastic square. A simple viewer lets you select any page and projects it for you.



How PCMI works: The original document is reproduced in miniature on high-quality microfilm which is then fed into the PCMI camera recorder. Ultraviolet light is then projected through the microfilm and onto the PCMI film to form an even tinier image. When all exposures are complete and the film has been checked for errors, the entire block of images—the "master"—is contact-printed onto permanent photographic film. These are enlarged in the viewer.

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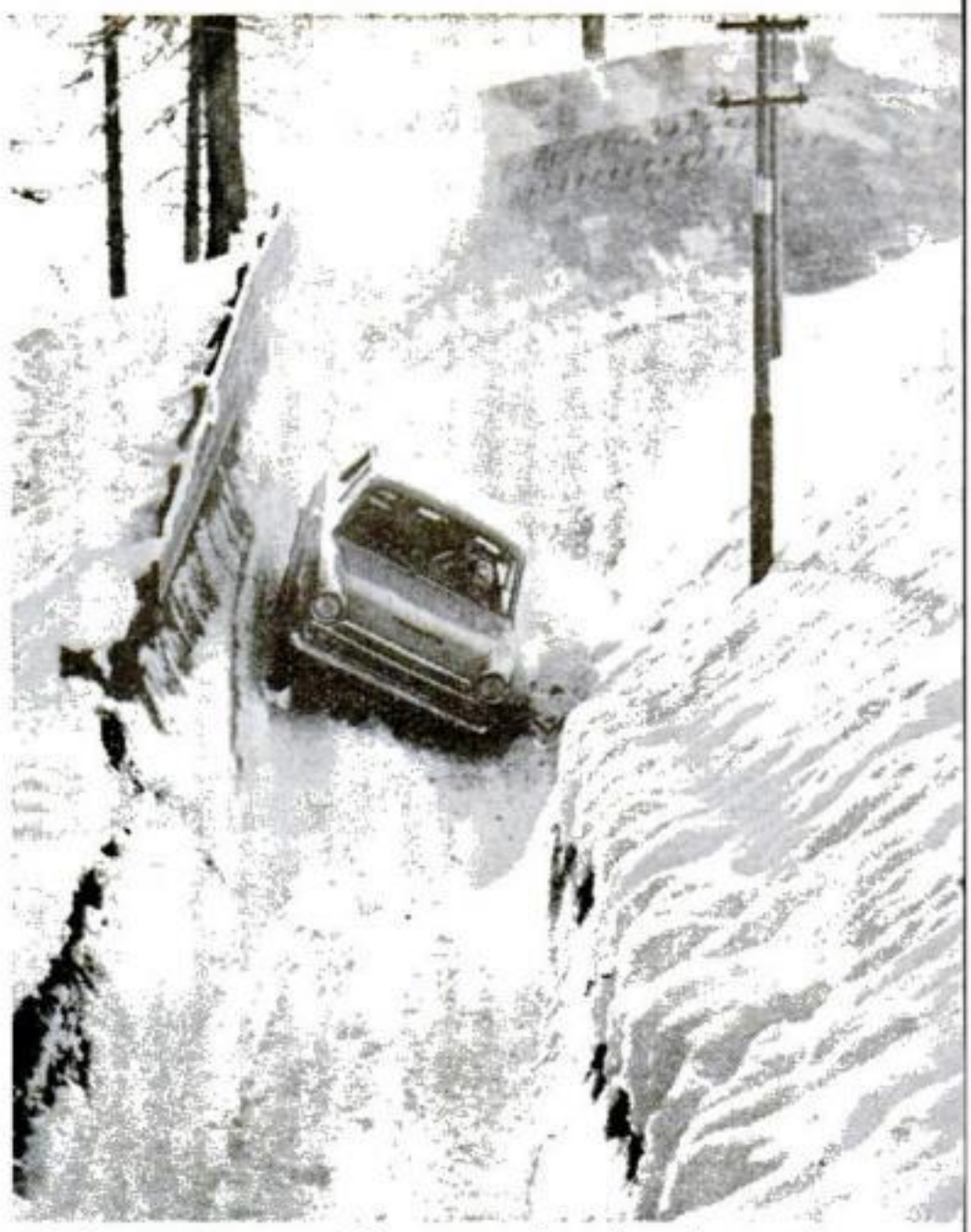
New sports thrill: bobsledding in a car

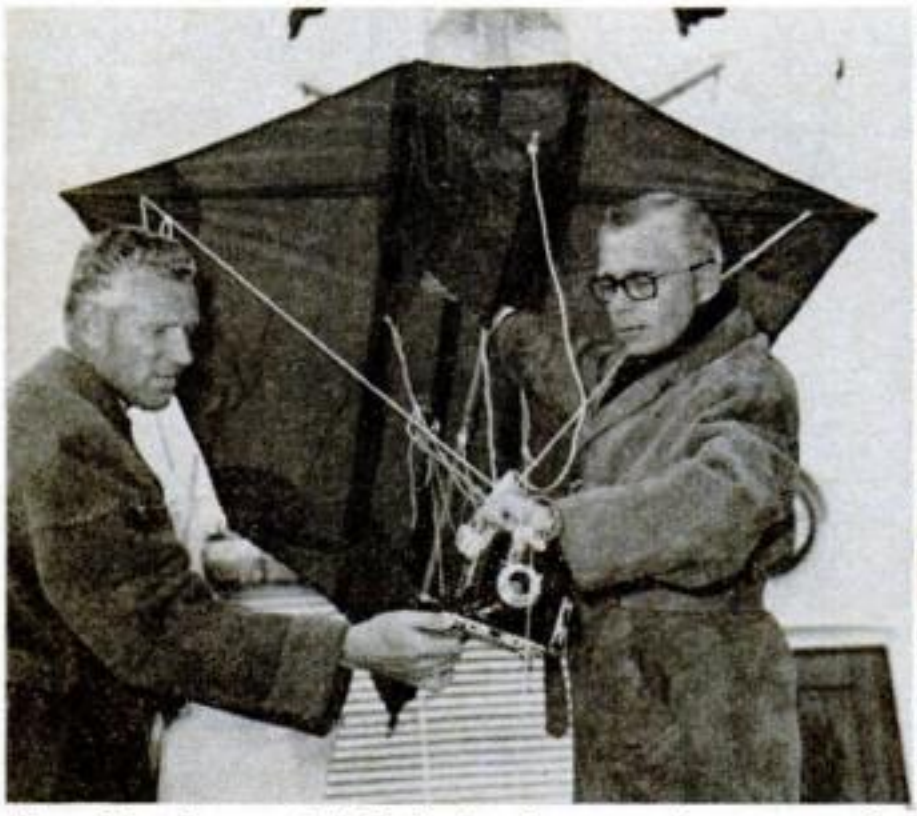
Race drivers have come up with a new one. For that ultimate thrill, they speed their cars down the twisting, banked championship bobsled course at Cortina d'Ampezzo in the Italian Alps' Dolomites range. Those who have made the tortuous run at 50 m.p.h. or more say it makes the hazardous Alpine and Monte Carlo rallies and Watkins Glen appear tame.

Bends are so treacherous, even for bobsleds, that the builders have erected wooden barriers at the most murderous to prevent going over the top. Straightaways are so narrow for cars they provide barely six inches of clearance.

Twenty of the world's top racing drivers tried their hand at the sport this winter. Pointers on where to watch for the most tricky spots were given by Lamberto Dalla Costa, who won the Olympic bobsled championship on the same run in 1956. Jim Clark, British racing champ, beat Dalla Costa's bobsled time in a British Ford Cortina with an average of 55 m.p.h.



Clark goes into straightaway at breakneck speed.



Van Meekeren (right) ties inexpensive expandable camera to kite. So far, he's lost none.

Mid-Atlantic shot is taken from kite above stern. Towline runs through picture, at left.

Kite-borne camera snaps liner at sea

A camera on a kite took this aerial photograph (above, right) of the Holland-America liner Statendam. Photographer Hank van Meekeren hung the camera on the framework and flew the kite on a 500-foot nylon towline. A clockwork rig tripped the shutter for a single exposure after the kite had become airborne. Van Meekeren has taken shots from as high as five miles by stringing out a number of kites.

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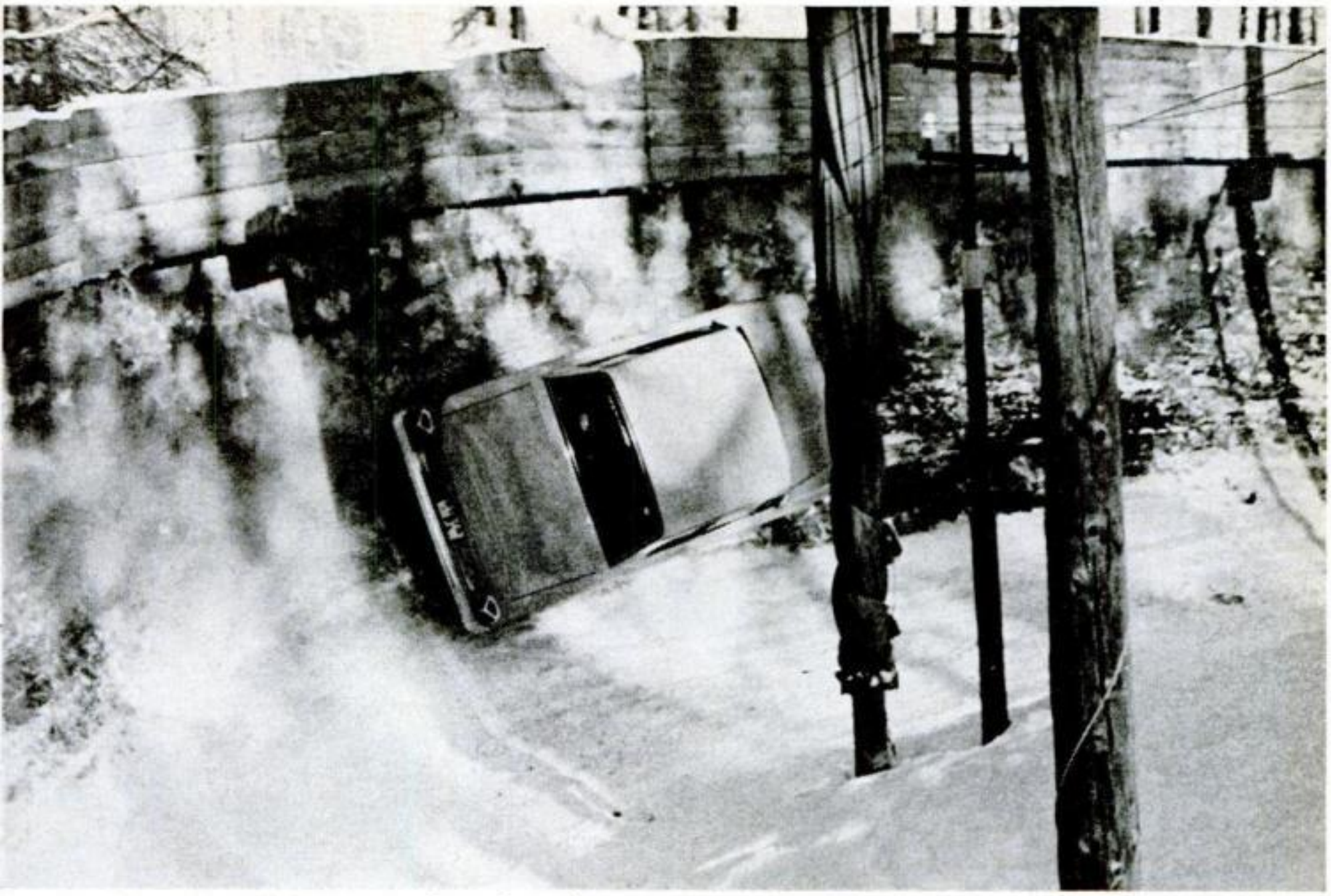

Rear view of Cortina on hazardous curve cresting stone embankment topped by wooden barrier.

Picture windows enclose truck cab

A high and wide windshield and glassed-in sides give 26 square feet of unobstructed vision from the cab of a new British delivery truck. Sliding doors provide access to its low-level step-in cab and the cargo area behind, which can be loaded from the back by a full-length roll-up door. The box truck body has a fiberglass roof both for insulation and to save weight.

Supermarket cart floats on air

Seems no end to what they'll think up for air-cushion vehicles. Now it's the supermarket cart shown above. Called in England a hoverbag, it has a propeller blower (clearly visible in this overhead view) enclosed in a skirt that traps the air-lift bubbles. Power is from a model-airplane engine, and the contraption is maneuvered by the handle the lady is holding.

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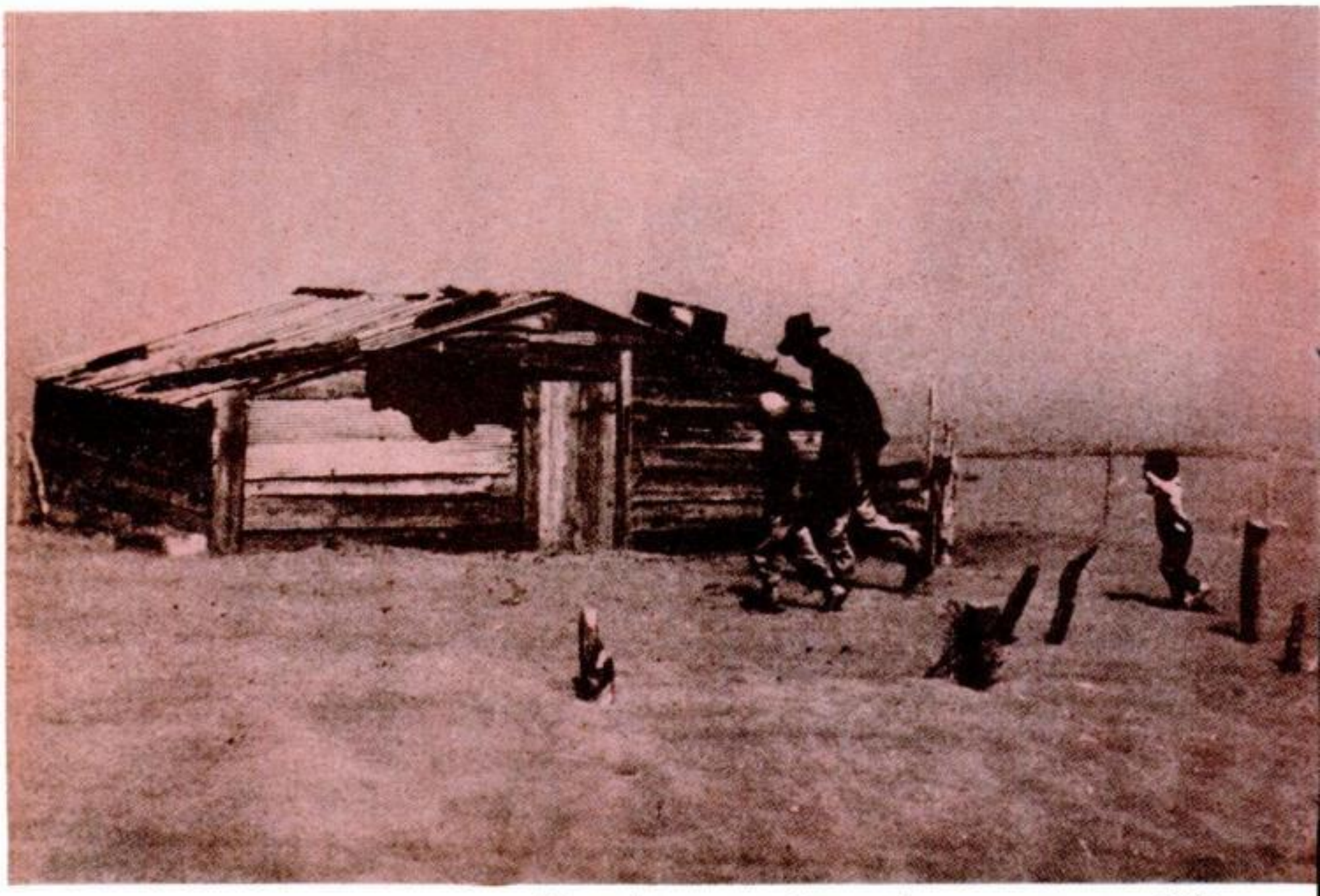
THE WEATHER:
Now We Can Do



Coming: water where we want it—

Grand-scale plans in the works include regional and global weather modification —a dazzling hope or "a mightier weapon than the ICBM"?

By Alden P. Armagnac

WE'RE going to change the weather—in a big way. Americans are rebelling against droughts, hurricanes, and floods such as 1964 sent our way. And now scientists offer us early promise of tailoring the weather more to our liking.

This year will see the beginning of a spectacular scale-up in U.S. weather-making trials, with a vast Colorado River Basin snow-inducing project and a dramatic attempt to destroy a hurricane. Picturesque new ways of rain-making are being readied. And—hold your hat—far bigger things are ahead.

Weather control on "regional or continental scales" is now the ultimate goal of our National Weather Modification Program. Recent advances make possible that breathtaking statement by the National Science Foundation, the federal agency that is co-

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Something About It

instead of devastating droughts and floods

ordinating and supporting the others' weather-making efforts. In its own words:

"Investigation of the possibility of truly large-scale weather modification, just now beginning, has become a serious scientific undertaking. The time for rapid progress appears to be at hand. National boundaries cannot contain the results of large-scale weather modification that may some day be possible."

Implications are awesome. You recall warnings of Dr. John von Neumann, former AEC commissioner, and of Dr. Edward Teller of H-bomb fame: Large-scale control of weather would give a nation a mightier weapon than the ICBM. The NSF's brighter view sees it as a dazzling hope: "The rewards to be gained may equal or surpass atomic energy in dealing with the world's population explosion and other problems

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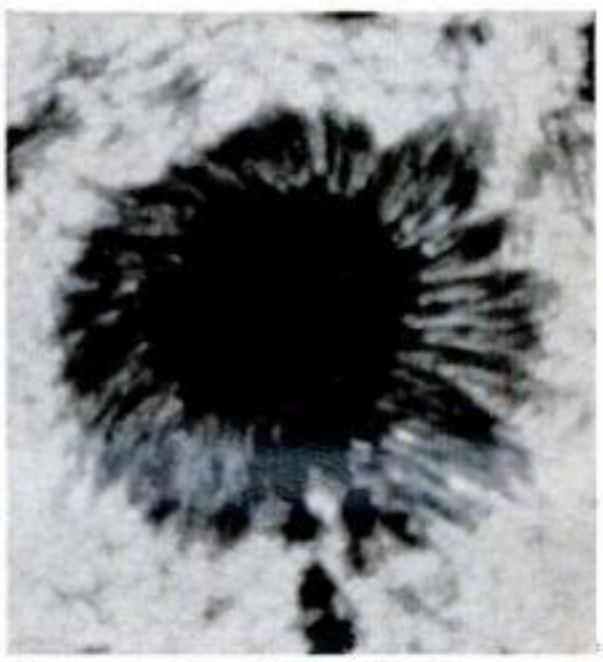

Sunspots like this, altering sun's radiance, are linked to our varying weather. We can't change sun's spots—but we can remodel the weather right here.

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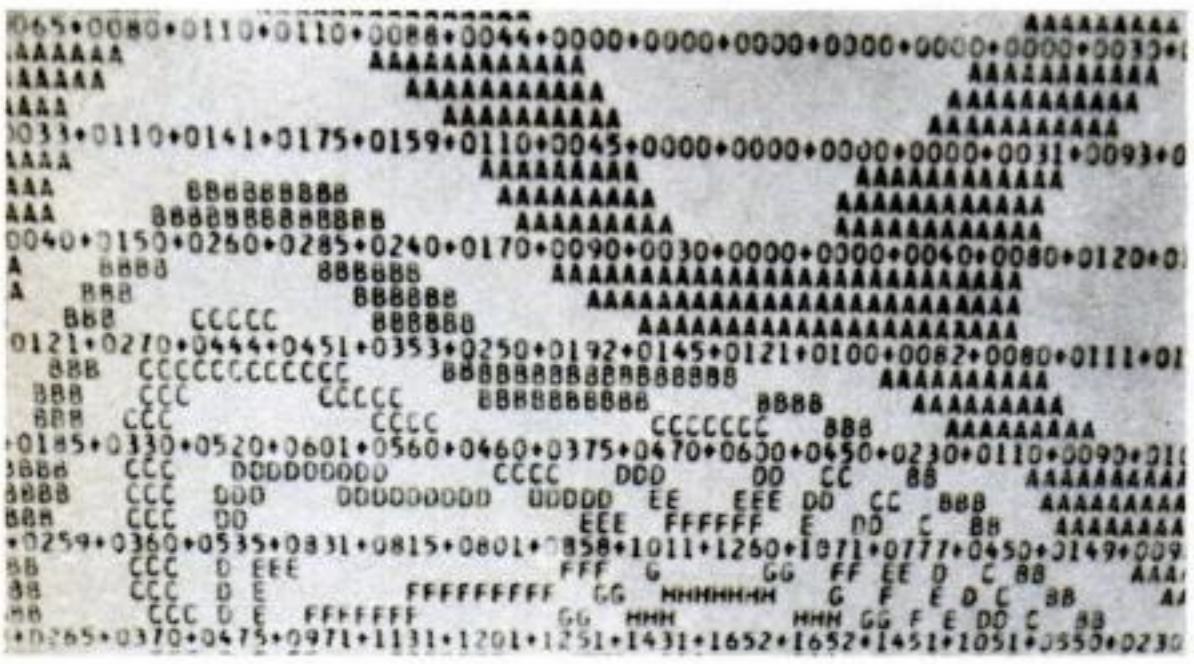
"National boundaries cannot contain the results of large-

Super computer will yield key to weather control

Creating model of atmosphere with computer, a breakthrough now taking place, will enable grand-scale weather-making plans to be tested—and clear way for their use. Above, Dr. Joseph Smagorinsky (left), pioneer modelmaker, and Dr. F. W. Reichelderfer, Weather Bureau chief, examine charted instructions for IBM Stretch computer in background. Adapted as model, computer prints out long-range forecasts, in form of numerical weather maps like sample below. Comparing them with actual weather shows how accurate the model is.



requiring maximum benefit from natural resources."

With grand-scale weather control, you might break a drought, like the Northeast's record one of 1964. You might avert disastrous floods like Oregon's, last year, by diverting storms that threatened them. You might abolish hurricanes altogether, by eliminating conditions spawning them. Imagine, too, the boon to arid lands, if you could redistribute the world's rain where it's needed—for enough falls to provide every person on earth with 30,000 gallons daily.

On the way to such bold plans comes the immediate goal of local weather modification—still to be attained as conclusively and by a repertory of methods as versatile as is wanted.

First: cloud seeding. U.S. attempts to change the weather date from the debut of cloud seeding—in 1946 with dry ice, and in 1947 with silver iodide, the workhorse of the rain-makers ever since. To use it, they burn an acetone solution of the light-yellow powder in ground and airborne "generators."

Watch a ground generator whoosh into action and you see its 12-to-18-inch propane flame turn bright orange as the chemical is fed in. Against the sky, only shimmering heat waves are visible—but a plume of microscopic silver iodide crystals is rising and spreading, miles downwind and sideward. The idea is to supply particles, sometimes scarce in clouds, on which ice crystals will form and grow until they fall to earth—as snowflakes or as raindrops if they melt on the way down. Despite 19 years' trials, how well it works remains controversial today.

A 10-year, $10-million-or-more cloud-seeding project in the upper Colorado River Basin, launched last November by the U.S. Bureau of Reclamation and now getting under way, should settle that question once and for all. Its immediate aim: to relieve an

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scale weather modification that may some day be possible"

acute water shortage, from recent years' droughts, in the great Colorado system of reservoirs. Says Walter Gartska, Bureau scientist in charge: "It is an endeavor of surpassing importance to the nation."

Along the Continental Divide in the Colorado Rockies lies the project's 10,000-square-mile area—larger than the whole state of Massachusetts. About a dozen storms a year bring almost all its rain and snow. Planners hope to coax down 5 to 10 percent more by cloud-seeding these storms—especially the ones of late winter and early spring, whose snowpack yields most of the runoff. To confront skeptics with proof, they're installing the most elaborate instrumentation a cloud-seeding project ever had.

They frankly call their program a gamble—but a good one. The "orographic" or mountain-type storm clouds here are the kind considered most amenable to cloud seeding. And just five percent more snow will repay the project's yearly cost many times over. The extra water annually will yield electric power worth $2,500,000—and, if used for irrigation, crops valued at $25,000,000. If put to municipal or industrial use, it will be worth much more.

An all-out air attack on a hurricane this year will climax the joint anti-hurricane "Project Storm Fury" of the Weather Bureau and Navy. The weapon: a Navy-devised pyrotechnic "bomb" that releases silver iodide in vertical sheets 20,000 feet deep.

In small-scale trials these bombs temporarily abated 1961's Hurricane Esther and 1963's Hurricane Beulah —by spreading each storm's whirling vortex outward, so that a lengthened path slowed the circling wind. But a respite let each groggy hurricane recover its violence. A real impact would take a continuous attack over at least 12 hours, the experimenters concluded. Now they plan to try it. Planes will make up to half a dozen "bombing" runs, several hours apart, on a 1965 hurricane selected as a target. If it works, the storm will be "exploded" outward, and its savage force tamed for keeps.

Weather-making methods coming next may match or excel cloud seeding in importance, says the NSF.

Electrical weather-making. One new scheme applies a theory that natural electrical charges help a cloud make rain or snow—and so might artificial charges. And by neutralizing natural charges, rain and snow might be prevented. Experiments show that sizable positive or negative electric charges can be boosted to cloud height from hair-thin wires of stainless steel, fed with 10,000-volt direct current. In a typical trial, these were strung for four miles across

How to change weather on a grand scale: four ideas

Polar ice cap could be warmed by heat-absorbing coat of lampblack spread from planes.

Ocean could get film of evaporation-preventing cetyl alcohol, now used on reservoirs.

Vast man-made cloud, perhaps formed by spray from nuclear bombs, could blanket Arctic.

Rocket-borne materials might trigger energy, screen radiation, in upper atmosphere.

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How they seed the clouds for rain, 1965 style

A propane-burning "generator" sends plume of silver-iodide crystals aloft, to make rain for reservoirs of Los Angeles Flood Control District.

Radio-controlled generator, being adjusted here, is one of network operated by Pacific Gas & Electric, biggest public utility in this country.

central Illinois farmland, hung 30 feet above ground by insulators on poles.

The next step, to practical use, may be taken by a railroad. Interested in warding off snowfall, the New York Central Railroad reports it's ready to try the electric method, after studies at its own Cleveland Technical Center. It would undertake rainmaking, too, as a public service, for a national or state agency that assumed liability. A railroad's an ideal site for the electrified-wire installation, it notes—already having the long right-of-way and the poles.

Open flames of a ring of 125 oil burners, on a plain in southern France, employ another new rainmaking idea. This "convection" method heats moisture-bearing surface air to loft a column of it skyward—so that its chilling as its ascends will condense the moisture to clouds and rain. The fiery French device, consuming a ton of fuel a minute, is reported to conjure up rain clouds out of a clear blue sky.

Those represent upcoming techniques of which you can expect to hear more in the immediate future.

What's ahead. And then will come the "regional or continental" weather-making to which the NSF has lately raised its sights.

Meteorologists offer a number of suggestions for imaginable big-scale ways to alter weather: spreading lampblack over a polar ice cap or light-colored desert; coating an ocean with an evaporation-preventing chemical film; blanketing the Arctic with a vast artificial cloud; injecting rocket-borne chemicals or dust into the upper atmosphere; diverting ocean currents. Results might be felt at remote places on the globe; meteorological events in the Gulf of Alaska, for example, often breed U.S. weather.

The danger. So far as we know, none of the 20 nations working on weather-making (including Soviet Russia, openly keen to warm its frozen northland) has yet tried it on a major scale. Unpredictable consequences have made it too risky—a rash attempt to thaw the Arctic might even bring on a disastrous Ice Age, instead. What's happening now, that makes U.S. scientists think so big, amounts to an exciting breakthrough:

With supercomputers, our weather men are making a dream come true—to produce a model that will behave just like the earth's circulating atmosphere. It will enable them to predict the weather farther in advance than ever before. And, by simulating a major weather-making plan, it will foretell precisely what the effects will be, and where.

At the Weather Bureau's General Circulation Research Laboratory, in Washington, a leader in the breakthrough, they make a model this way:

[*Continued on page 206*]

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One Engine Has the Best Chance to Win This 500

This is the second of four articles on the Indianapolis 500 by POPULAR SCIENCE's *popular columnist, Smokey Yunick, ace auto mechanic and veteran race-car builder. In it he tells what engine he thinks will emerge the winner in this year's race, to be run May 31.*

By Smokey Yunick

TWICE in the last two years a Ford V-8 engine almost won the Indianapolis 500. This was a specially engineered, hand-built, high-performance engine. Last year it even had twin overhead cams.

One day last fall I telephoned my old friend Lou Meyer in Los Angeles. Lou makes Offenhauser racing engines. They're good—they have won the Indianapolis 500 all but three times since 1934. Lou, incidentally, is himself one of the few three-time winners of this classic.

Now Lou had been appointed sole agent for selling the Ford overhead-cam racing engine outside the Ford organization. There was a reason for this. By appointing Meyer, the Offenhauser man, Ford neatly pulled the teeth of any critics who might claim that the company was trying to dominate the event.

Lou was offering Ford engines for sale. The offer was good from noon on Oct. 5, 1964, to midnight, Oct. 10. When I called him, it had 24 hours yet to run.

I wasn't interested in buying an engine. I just wanted to get the lay of the land.

"Can you extend the offer?" I asked.

"No."

"How many engines have you sold?"

"Ten or more."

"Who bought them?"

"You've never heard of them," said Lou.

Money-back deal. Now, let me explain something. When a big corporation makes racing engines, it devises ways for the buyer to get his money back. Sometimes the repayment takes the form of service, sometimes in other things. This is all understood before the purchase is made. The cost of the engine is the manufacturer's investment in publicity.

"When do I get my money back?" I asked Lou.

"Smokey," he said, "when I get your check, I cash it, period."

"What will two engines cost me?"

"Let's see your check for $30,000."

The exhaust system was extra.

So that's the way it is with Ford at Indianapolis for 1965. Although Ford is determined that a Ford engine will win, it wants to keep the Ford vs. Ford competition to a minimum. I don't blame them.

A natural question presents itself. With two near-misses, in 1963 and 1964, behind it, what stirs Ford to such a frenzy to win this year?

Racing is part of Detroit's current image-making. In 1955 Chevrolet's Ed Cole said, "Let's appeal to a young people's market with performance." So Chevy got performance and began taking off in stock-car races like a skyrocket. Later Pontiac's Bunky Knudsen did the same with his car. Still later, Ford and Chrysler began building successful racing stockers.

Indy would give Ford a top speed image.

Who'll win? That brings us down to the '65 Indianapolis 500. I would put my bankroll on a Ford-powered racer this year. What Ford has done to win, you couldn't begin to pay for. Each of those Ford-Lotus engines is easily worth $40,000 on the track—and has cost millions.

Meyer's Offies probably will continue to run at Indy. But in Ford's third year in the 500, I don't think the Offies have a prayer.

Next month I'll tell you about Ford's competition this year at Indy.

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When Will

An expedition on the way to Mars

"Mars Mission Module" envisioned in NASA drawing is manned earth-to-Mars spacecraft containing two other capsules: excursion module for descent to Mars' surface, and re-entry module for return to earth. Dish-shaped appendages shown extended at sides are solar collectors for generating power on the long interplanetary voyage.

A space authority takes a look at the rocket ship, equipment, and possible date for a manned interplanetary expedition

By Dr. Wernher von Braun

Director of NASA's George C. Marshall Space Flight Center, Huntsville, Ala.

Dr. von Braun, seated, gives Rep. Roman C. Pucinski his views at House hearing on proposed National Science Information Center.

NOW that we have an unmanned spacecraft on the way to Mars, and have already sent a highly successful one past Venus, the question is being heard, "When may we expect manned interplanetary expeditions?" For a realistic answer, let us appraise the magnitude of the task and compare it with our present capabilities.

Suppose we try to describe, as best we can today, what the first manned expedition to Mars may really look like:

Place of departure. It is fairly certain that a manned Mars expedition will not start from the earth's surface—but from a low "departure orbit" around the earth. There, the interplanetary ship will be assembled, from loads hauled up by earth-to-orbit cargo rockets.

Size of crew. A Mars expedition may require a crew of 6 to 10, or more. For an interplanetary voyage, there are several arguments for a bigger crew than the trio of astronauts who will make the much briefer Apollo moon trip. The length of the Mars expedition increases the chances that a crew member might become sick and require a doctor's care, as well as replacement. Adding a few crew members can give

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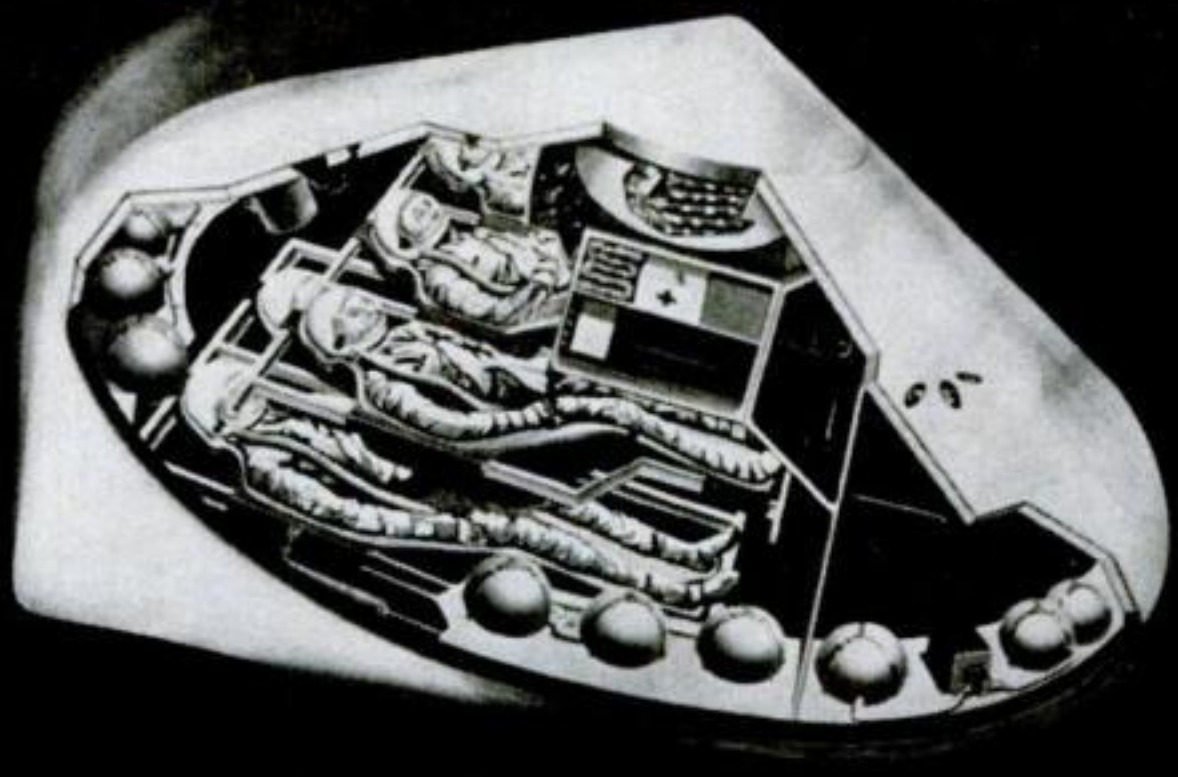
We Land on Mars?



The homecoming—full-speed re-entry

Crewmen lie on couches, arranged in two tiers, to take G forces of hitting earth's atmosphere at high speed, in NASA conception of Mars expedition's re-entry capsule. Dispensing with rocket braking saves having to haul propellants for it all the way to Mars and back.

the expedition much greater scientific usefulness. And since the equipment will be more complex than for a moon trip, it will need more monitoring and maintenance.

The interplanetary rocket ship. For its power maneuvers, in earth orbit and near Mars, we can assume that the spaceship will be designed to use one of these two forms of propulsion:

- High-energy chemical engines, burning liquid hydrogen and liquid oxygen.
- Nuclear engines, of Rover type with a solid core, using liquid hydrogen as the sole propellant. These would provide nearly twice the "specific impulse" (a measure of propulsive efficiency) of chemical engines.

Payload. Besides the weight of the ship itself, its crew, and its propellants, we shall have to plan for sizable items of payload, including:

- Enough oxygen, food, and water to supply all the crew members for the duration of the expedition.
- A simple radiation shelter—since bursts of solar radiation, reasonably predictable for short periods like that of an Apollo round trip to the moon, cannot be forecast for the long time span of a voyage to a planet and back.
- A spinning crew compartment to provide artificial gravity, or at least a centrifuge for occasional exposure to it.
- Radio equipment capable of covering interplanetary distances reliably.

To arrive at any estimate of what all these items will total, we must now examine such things as the distance, time, and flight plan in more detail.

Distance. Comparison with a flight to the moon will help to put an interplanetary flight in perspective. The average distance between earth and moon is 238,860 miles, and a typical Apollo trajectory is only slightly longer.

Venus' and Mars' closest approaches to earth are 26 million and 35 million miles, respectively. But Mariner II had to travel along a curved circum-solar trajectory of 180 million miles to intercept Venus. Mariner IV, now headed for Mars, will have covered 325 million miles before getting there.

Flight times. A typical one-way flight to the moon requires 2½ to three days. Mariner II's flight to Venus took almost four months. Mariner IV will be on its way to Mars for eight months. These are one-way flight times. However,

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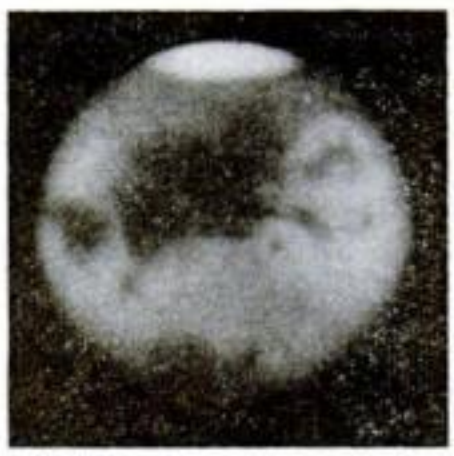
nobody wants to go on a one-way trip into space.

A typical Apollo round trip to the moon, including a 24-hour surface stay, will last about 10 days. A typical estimate of round-trip flight time for a manned expedition to Mars is 400 to 450 days, including a 20-day stay on Mars. This takes into account the fact that, to get back from another planet with a reasonable expenditure of propellants, the return flight must be made when that planet and the earth are in reasonably favorable positions in their orbits.

Velocity requirements. To reach the moon, a spacecraft must acquire a speed just a trifle less than the earth's escape velocity, which is the speed required to escape permanently from the earth's gravitational pull.

For a one-way flight to Venus or Mars, the spacecraft need not reach a very much higher speed. Just a trifle *more* than escape velocity suffices to carry it out of the earth's field. The spacecraft will enter a circum-solar orbit that will carry it farther away from the sun (for instance, to Mars) or closer to the sun (for instance, to Venus), depending on whether the excess speed is in the direction of the earth's orbital motion around the sun, or in the opposite direction. The actual velocity at which the spacecraft enters its trajectory to Mars or Venus will equal the earth's own tremendous orbital speed, 18½ miles a second, plus or minus that small excess speed with respect to the earth.

For the return trip, the velocity requirements are of the same order of magnitude as for the outbound voyage. But every ounce of rocket propellant to be consumed in leaving Mars represents payload for the outbound leg of a Mars expedition's journey—and many more ounces of propellant must be consumed to get it there. This is a fundamental difference between the power requirements for a one-way and a round-trip interplanetary mission.



Planet Mars challenges spacemen to land and solve its mysteries. Telescopic photo shows its mottled surface and white polar cap.

Landing on a planet. For man to set foot on a planet, he must first retard his spacecraft so the planet can "capture" it. From the resulting orbit around the planet, the explorers can then descend to its surface in a landing capsule that, of course, must provide rocket propulsion for re-ascent to orbit when the surface mission is completed.

In principle this resembles the lunar landing and re-ascent with the Apollo "Bug." In landing on a planet with an atmosphere, however, judicious use of aerodynamic braking can conserve the expedition's supply of rocket propellants.

Re-entry. Using aerodynamic braking to save rocket propellants becomes particularly important during the terminal maneuver of a Mars expedition—the return into the earth's atmosphere.

Reaching another planet takes more than earth-escape velocity, we have noted; and a returning spacecraft will likewise approach the earth's atmosphere with a speed in excess of earth-escape velocity. Thus return from Mars or Venus will always be at higher velocity than the sub-escape speed at which an Apollo Command Module returns from the moon.

If we can build a Command Module for a Mars expedition that can safely withstand the higher re-entry speed, we can avoid having to slow it down with rocket power to sub-escape speed as it approaches re-entry. This would be of great practical significance—for any power braking would have to be done with propellants hauled all the way to Mars and back, just for this final maneuver. Fortunately it looks as if such super-escape-speed re-entry capsules can indeed be built.

How it adds up. From all the foregoing facts, we can now estimate the

[*Continued on page 184*]

Urheberrechtlich geschütztes Material

Here's your guide to

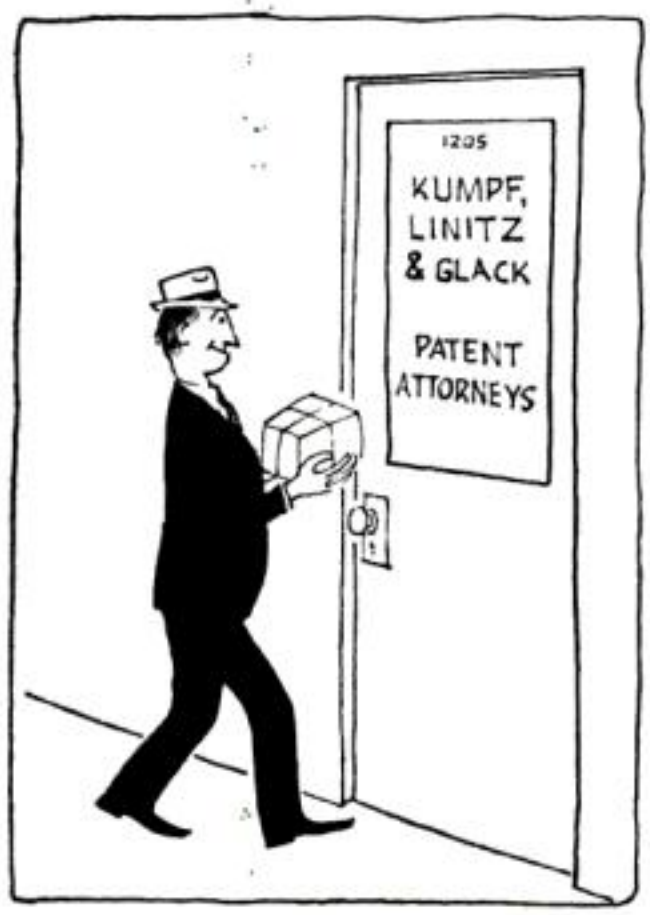
in

Two top experts in the field tell you how to cash in on your marketable ideas

By Norman Carlisle and K. O. Kessler

YOU have an invention. Or perhaps simply an idea for an invention. What do you do with it? How do you protect it, develop it, and turn it into the moneymaker you think it can be?

Here, in simple question-and-answer form, are some of the most important problems you'll face, and some pointers on how you can solve them and cash in on your invention.



Q ***Are there any organizations in my area that will help me develop and market my invention?***

A Yes. Inquire of such organizations as chambers of commerce, banks, and area departments of power companies and railroads. Many communities have locally financed industrial-development organizations that can help you locate manufacturers and individuals who might be interested in promoting your idea.

Q ***Will the Patent Office help me in developing and marketing my patent?***

A Only to a very limited extent. The Patent Office cannot act or advise concerning the business transactions or arrangements that are involved in the development and marketing of an invention. However, the Patent Office will publish, at the request of a patent owner, a notice in the "Official Gazette" that the patent is available for licensing or sale. The fee for this is $3.

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From the book, "The Successful Inventor's Guide." © 1965 by Prentice-Hall, Inc., Englewood Cliffs, N.J.

Urheberrechtlich geschütztes Material

Want to know what inventions the Armed Forces are

Q ***Can any other U.S. Government agency assist me in developing and marketing my invention?***

A The Business and Defense Services Administration of the U.S. Department of Commerce, Washington 25, D.C., may be able to help you with information and advice, as its various industry divisions maintain close contact with all branches of U.S. industry; or you may get in touch with one of the Department of Commerce field offices.

The Small Business Administration publishes a monthly products list containing brief descriptions of issued patents likely to interest prospective manufacturers; these lists are distributed to many business organizations. You may write the agency requesting that your invention be listed in this publication, and your request will usually be granted. The Small Business Administration has more than 50 offices in the country, and it offers, through its products-assistance program, information and counsel to small concerns interested in new products.

Q ***Will the Patent Office advise me whether a particular patent-promotion organization is trustworthy?***

A No. The Patent Office has no control over such organizations and cannot supply information about them. You may obtain this information by inquiring of the Better Business Bureau of the city in which the organization is located, or of the Bureau of Commerce and Industry of the state in which the organization has its place of business. You may ask your own patent attorney or agent what he knows of their reliability.

Q ***How can I find out what types of inventions the government needs?***

A The National Inventors Council publishes a booklet, "Inventions Wanted by the Armed Forces," describing unclassified problems confronting the military agencies. You may obtain a copy of this publication without cost from the nearest U.S. Department of Commerce field office or from the National Inventors Council, U.S. Department of Commerce, Washington 25, D.C. Just write and ask.

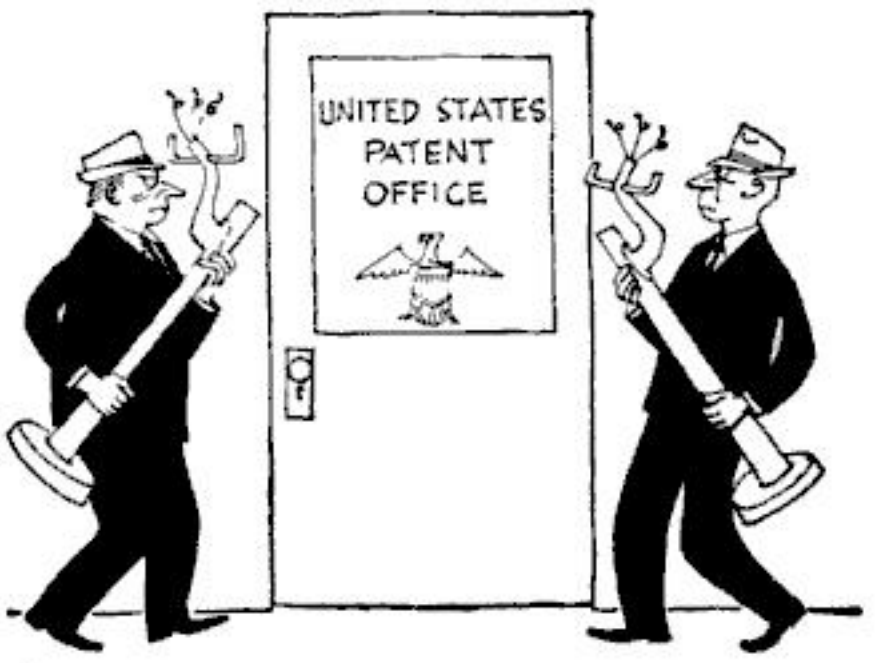
Q ***How do I apply for a patent?***

A By making the proper application to the Commissioner of Patents, Washington 25, D.C. This includes an application fee, a petition, a specification and claims describing the invention, an oath, and a drawing if the invention can be illustrated.

Q ***What are the Patent Office fees for filing an application and issuance of the patent?***

A A filing fee of $30 plus $1 for each claim in excess of 20 is required when the application is filed. A final fee of $30 plus $1 for each claim allowed in excess of 20 is also required if the patent is to be granted.

Q ***What happens when two inventors apply separately for a patent for the same invention?***



A An "interference" is declared and testimony may be submitted to the Patent Office to determine which inventor is entitled to the patent.

Urheberrecht ch geschütztes Material

looking for? You can get a list for the asking

Q ***Are models required as part of the application?***

A Only in exceptional cases.

Q ***Is it necessary to go to the Patent Office in Washington to transact patent business?***

A No, most business with the Patent Office is conducted by mail.

Q ***Is there any danger that the Patent Office will give others information contained in my pending application?***

A No. All patent applications are maintained in the strictest secrecy.

Q ***I have been making and selling my invention for the past 13 months and have not filed any patent application. Is it too late to apply for a patent?***

A Yes. A valid patent may not be obtained if the invention was in public use or on sale in this country for more than one year prior to the filing of your patent application.

Q ***I published an article in a magazine 13 months ago describing my invention. Is it too late to apply for patent?***

A Yes. The law provides that the inventor is not entitled to a patent if the invention has been described in a printed publication anywhere in the world more than a year before his patent application is filed—even if you write the article yourself.

Q ***Is there any restriction as to who may obtain a United States patent?***

A No. Any inventor may obtain a patent, regardless of age or sex, by complying with the provisions of the law. A foreign citizen may obtain a patent under exactly the same conditions as a U.S. citizen.

Q ***If two or more persons work together on an invention, to whom will the patent be granted?***

A If each had a share in the ideas forming the invention, they are joint inventors and a patent will be issued to

them jointly on the basis of a proper patent application filed by them jointly. If, on the other hand, one of these persons has provided all the ideas of the invention, and the other has only followed instructions in making it, the person who contributed the ideas is the sole inventor and the patent application and patent should be in his name alone.

Q ***If two persons own a patent jointly, what can they do to grant a license to some third person or company to make, use, or sell the invention?***

A They may grant the license jointly, or either one of them may grant such a license without obtaining the consent of the other. A joint owner does not need to get the consent of his co-owner either to make, use, or sell the invention of the patent independently, or to grant licenses to others. This is true even though the joint owner who grants the license owns

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Urheberrecht ch geschütztes Material

only a very small part of the patent. Unless you want to grant this power to a person to whom you assign a part interest, you should ask your lawyer to include special language in the assignment to prevent this possibility.

Q ***Then an inventor can sell or transfer his right to his patent or patent application to someone else?***

A Yes. He may sell all or any part of his interest in the patent application or patent to anyone. The application must be filed in the Patent Office as the invention of the true inventor, however, and not as the invention of the person who has purchased the invention.

Q ***While in England this summer, I found an article on sale that has not been introduced into the U.S. or patented or described. May I obtain a U.S. patent on it?***

A No. A U.S. patent may be obtained only by the true inventor, not by someone who happens to see it.

Q ***How can I be sure that my patent attorney or agent will not reveal to others the secrets of my invention?***

A Patent attorneys and agents earn their livelihood by the confidential services they perform for their clients, and if any attorney or agent improperly reveals an invention disclosed to him by a client, the attorney or agent is subject to disbarment from further practice before the Patent Office. Persons who withhold information about their inventions from their attorney and agents make a serious mistake, for the attorney or agent cannot do a fully effective job unless he is informed of every detail.

Q ***Does the Patent Office control the fees charged by patent attorneys and agents for their services?***

A No. This is a matter between you and your patent attorney or agent.

Q ***Will the Patent Office inform me whether my attorney or agent is reliable or trustworthy?***

A All patent attorneys and agents registered to practice before the Patent Office are expected to be reliable and trustworthy. The Patent Office can report only that a particular individual is, or is not, in good standing on the register at that office.

Q ***If I am dissatisfied with my patent attorney or agent, may I change?***

A Yes. There are forms for appointing attorneys and revoking their powers of attorney in the pamphlet entitled "General Information Concerning Patents," sold by the U.S. Government Printing Office, Washington 25, D.C.

Q ***Will the Patent Office help me select a patent attorney or agent?***

A No. The Patent Office cannot make this choice for you, as it would be unfair for it to select some of its practitioners for recommendation as against others.

Q ***For how many years is a patent granted?***

A Seventeen years from the date on which it is issued, except for patents on ornamental designs, which are granted for terms of 3½, 7, or 14 years.

Urheberrechtlich geschütztes Material

never bothered. You must be the true inventor

Q ***Does the patentee continue to have any control over use of the invention after his patent expires?***

A No. Anyone has free right to use an invention covered in an expired patent so long as he does not use features covered in other unexpired patents in doing so.

Q ***Where can I search to see if my idea is new?***

A In the Search Room of the Patent Office in the Department of Commerce Building, Washington, D.C. Classified and numerically arranged sets of U.S. and foreign patents are kept there for public use.

Q ***Will the Patent Office make searches for individuals to help them decide whether to file patent applications?***

A No. But it will assist inventors who come to Washington by helping them find the proper patent classes in which to make their searches.

Q ***Does the law provide patent protection for invention of new and ornamental designs for articles of manufacture, or for new varieties of plants?***

A Yes. If you have made an invention in one of these fields, you should read the Patent Office pamphlet "General Information Concerning Patents."

Q ***If I obtain a patent on my invention, will that protect me against the claims of others who assert that I am infringing on their patents when I make, use, or sell my own invention?***

A No. There may be a patent of a more basic nature on which your invention is an improvement. If your invention is a detailed refinement or feature of such a basically protected invention, you may not use it without the consent of the patentee, just as no one will have the right to use your patented improvement without your consent. You should seek competent legal advice before starting to make or sell or use your invention commercially, even though it is protected by a patent granted to you. A worthwhile improvement often can be sold to the holder of the basic patent.

Q ***I have an invention that may be of interest to the Armed Forces or other government agencies. How can I bring it to their attention?***

A The National Inventors Council was established for the specific purpose of helping inventors bring new and promising ideas to the attention of U.S. Government agencies. For information on the Council's policies and procedures, send for a free copy of "Facts About the National Inventors Council" from the National Inventors Council, Dept. of Commerce, Washington 25, D.C.

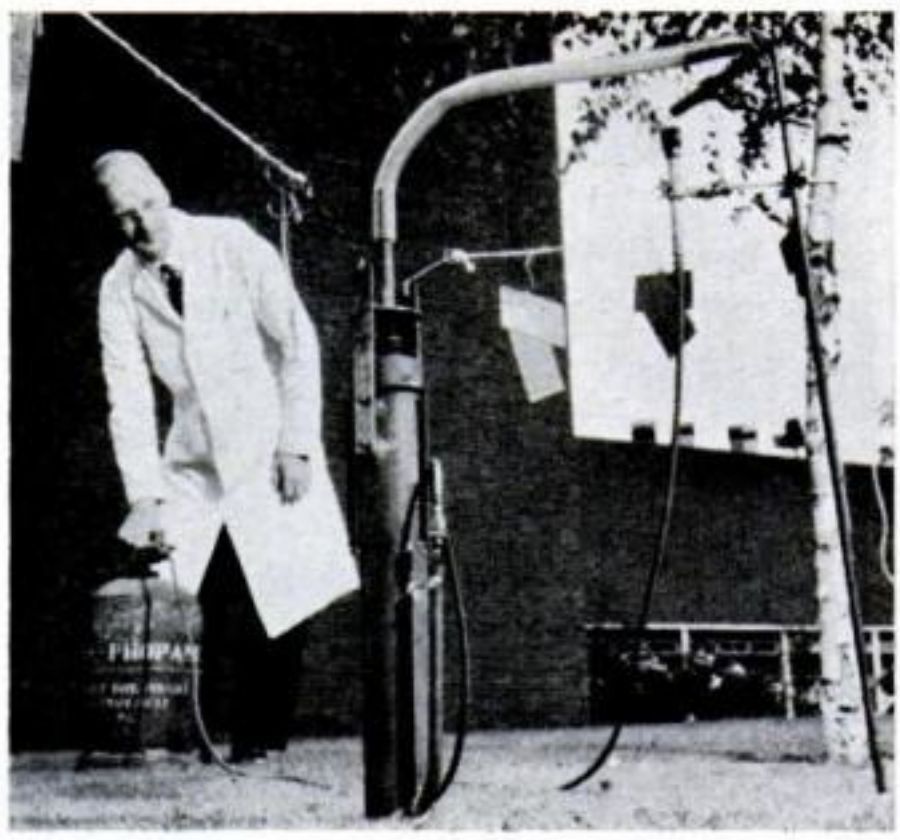
Q ***Will the Patent Office help me prosecute others if they infringe on my patent rights?***

A No. The Patent Office has no jurisdiction over questions relating to the infringement of patent rights. If your patent is infringed on you may sue the infringer in the appropriate federal court. But you must pay your own legal expenses. ■■

Urheberrechtlich geschütztes Material

Blow-up ladder for climbing on air

This ladder stretches to 26 feet when it is inflated. Collapsed, it rolls into a package 14 inches in diameter. Goodyear constructed it for emergency access into the Saturn-rocket fuel tank. The rubber-impregnated cloth is inserted into the tank's 18-inch opening, then pumped up for a technician to climb for inspection.



Mechanical scarecrow is for the birds

Noisy bangs and flashing lights send birds flying from a farmer's fields and protect his crops when the scarecrow shown above gets to work. Fired by propane gas, the device, developed by British Shell, sets off a low-power detonator every two minutes, each impulse jerking a series of lines on which are strung shiny metal reflectors that dance in the daylight.

Plastic tent isolates patient

Each bed at Walter Reed General Hospital in Washington is its own isolation ward when covered by a plastic tent that gets air from a ventilator at the foot. It protects burn patients and organ-transplant cases from infection, or it can isolate patients with communicable diseases. Nurses reach in through molded-in gloves.

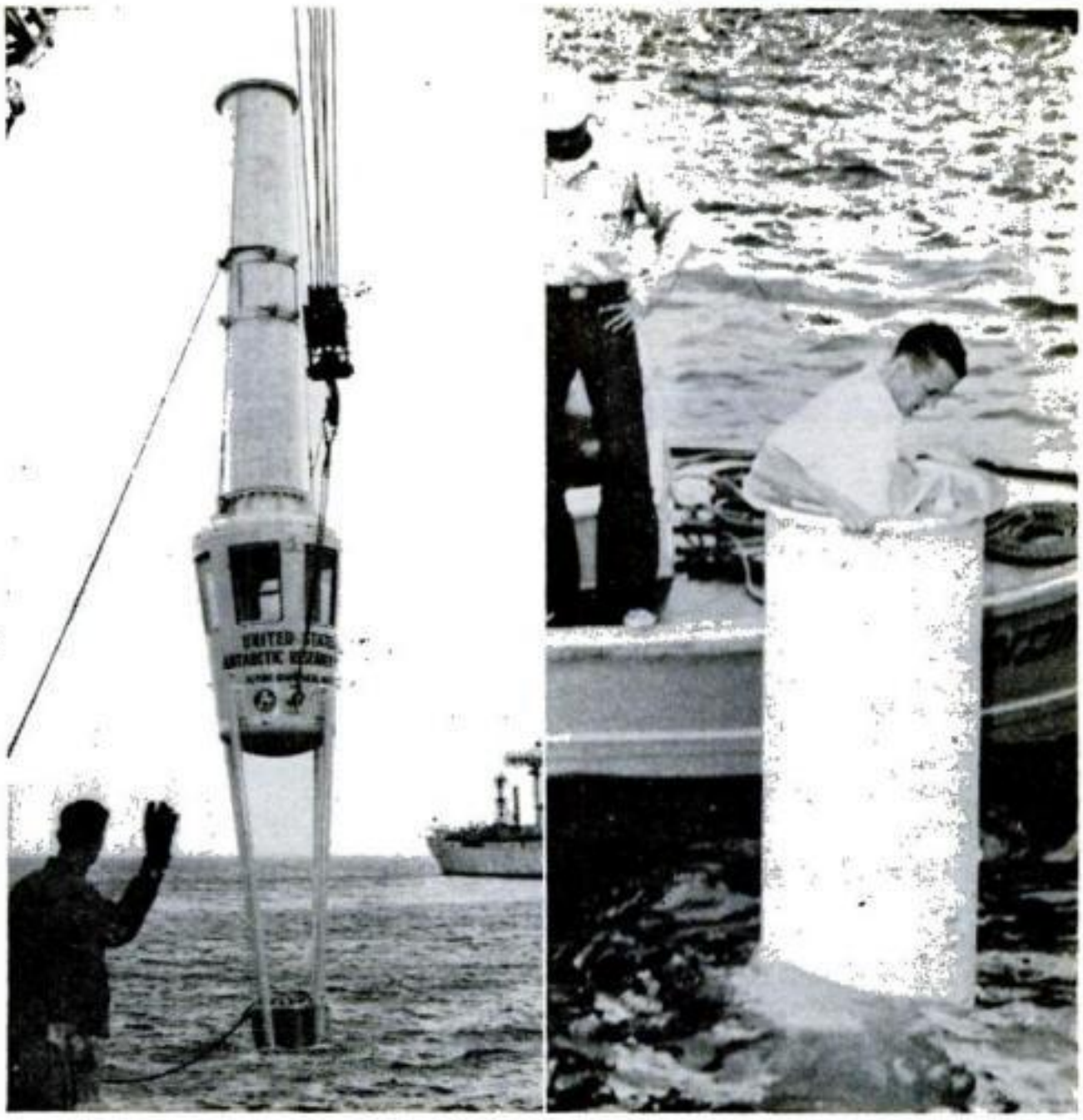
Urheberrechtlich geschütztes Material

For seal's-eye view under Antarctic ice

Observers in a diving tube studied seals at close range under five feet of ice in the Antarctic's McMurdo Sound.

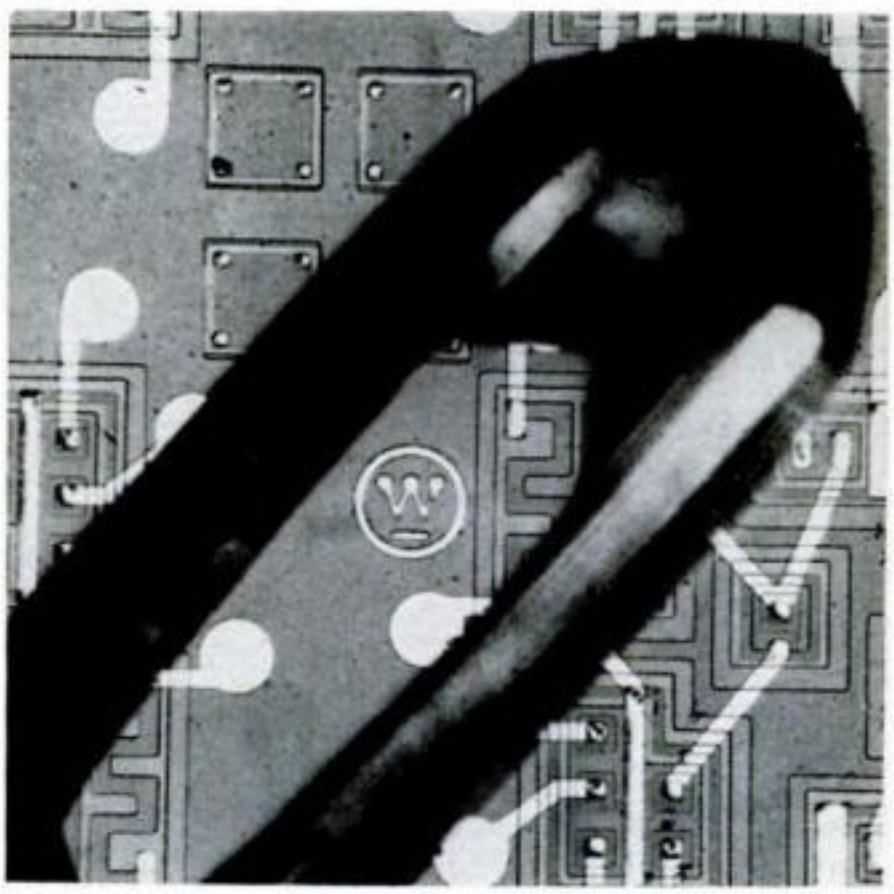
They entered an opening above water, as in tests at right in Narragansett Bay. Two at a time, for two weeks they took turns taping seal sounds through hydrophones—whistles, buzzes, beeps, and chirps. They're analyzing them now for clues to a language.

The observation chamber was built by Alpine Geophysical Associates, Norwood, N.J., for the National Science Foundation, Woods Hole Oceanographic Institution, and N.Y. Zoological Society.



Truck blends concrete mix on job

Sand, gravel, cement, and water go to the job in separate compartments in a new concrete mixer. With valves set for any blend ordered, the exact amount of any ingredient needed is poured, then shut off without waste. National Concrete Machinery Co., Lancaster, Pa., built the mobile machine to fill small special orders.



Trademark needs a microscope

What may be the world's tiniest trademark, shown above greatly magnified through the eye of an ordinary needle, is being used by Westinghouse on molecular electronic circuits. Dots at the peaks of the "W" are less than .001 inch in diameter; the circle surrounding the "W" is only .006 of an inch in diameter.

Urheberrechtlich geschütztes Material

The 24-foot Princess is an all-family boat—with a roomy cockpit aft, a full-headroom cabin, and sleeping accommodations for four. She'll take you out where the big ones go.

Complete and ready to go, this well-built 24-footer is a lot of boat for the money

By Jim Roe

SHE'S a salty sort of craft. That's not surprising, for the first look an Owens 24-foot Princess flagship gets of the outside world is a cove of Chesapeake Bay, where she is built.

What did surprise me, though, were all the things I found in this relatively low-priced boating package. I saw her built, and then had a chance to head out into the gray bay to put her through her paces.

I was impressed. At $5,645, this 24-foot MerCruiser-powered Owens is a lot of boat for the money.

First of all, she features a full-height transom. This can be no end of comfort to one's mind in a following sea. Heavily reinforced, the transom has plenty of beef to handle the big, 150-horsepower engine and stern drive. The boat handles like an outboard and is easy to drive as a step-up from a slightly smaller outboard craft.

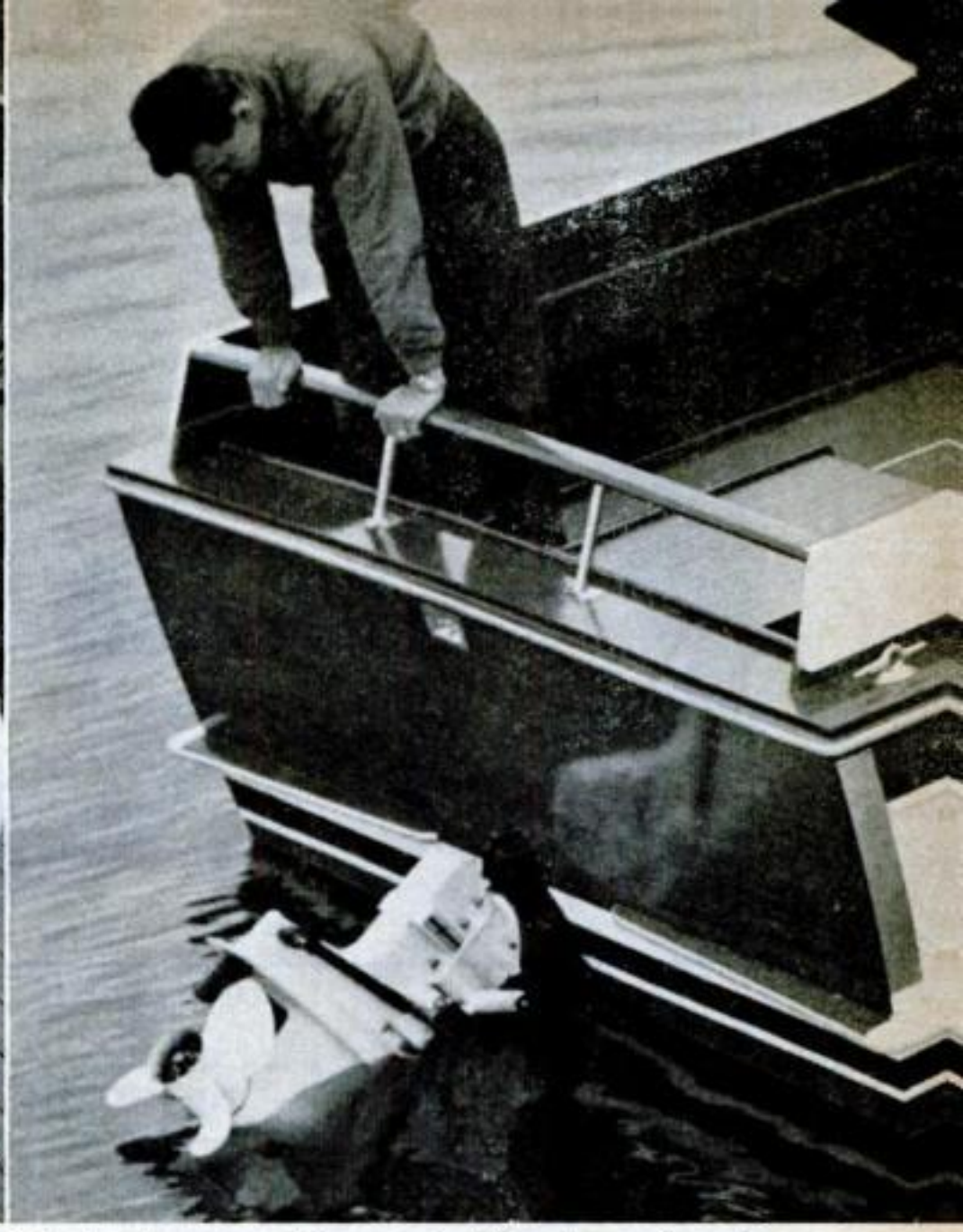
You don't have to learn any new steering tricks. You even retain the outboard advantage of being able to beach—with an improvement over normal outboard beaching. This is the electrically controlled power tilt on the stern-drive unit that allows you to press a button to lift the unit out of the water.

Forward of the transom, there's enough deck space for several fishermen. It's 7 feet 6 inches wide, and within an inch and a half of 10 feet long. A fully instrumented control station is at the forward end deck,

CONTINUED

Urheberrechtlich geschütztes Materia

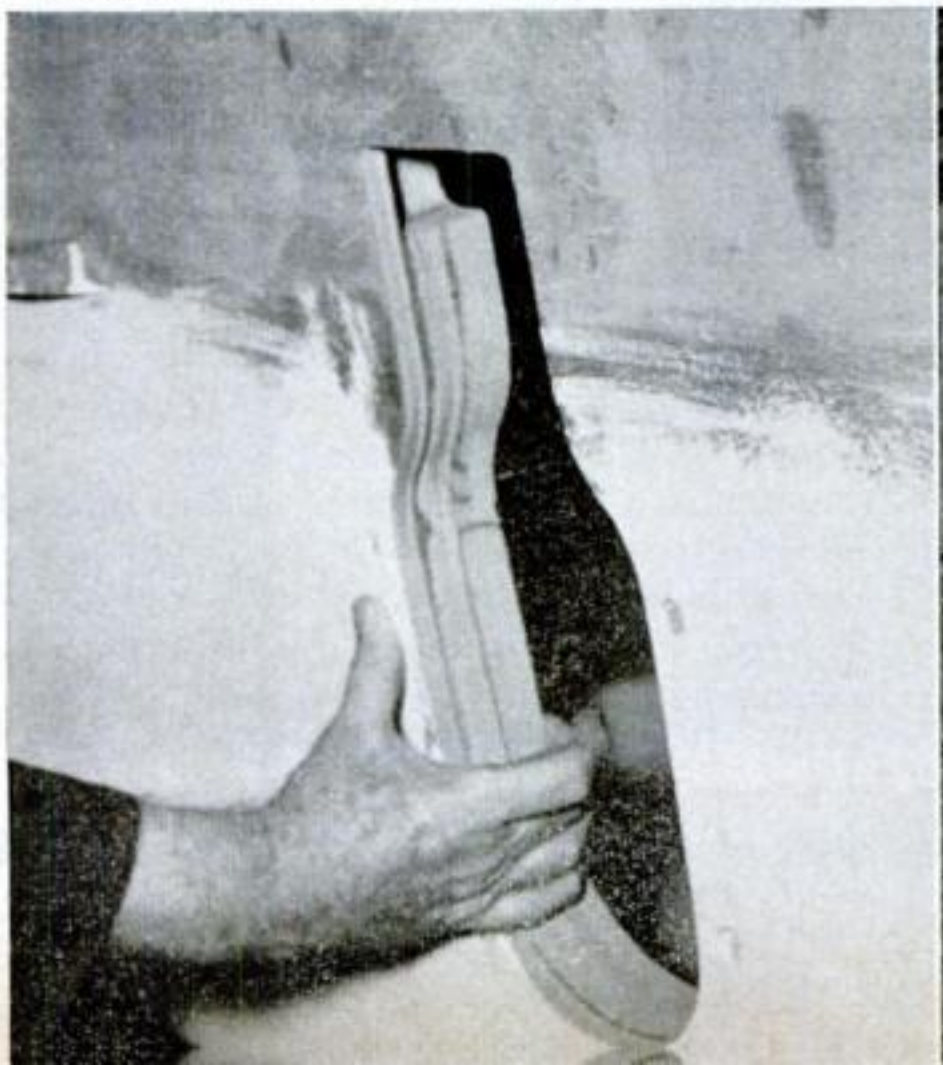
MerCruiser 150-hp. stern-drive power plant tucks neatly up against the transom. Compact motor box covers it, leaving ample room in the 7½-by-10-foot cockpit for sunning or fishing.



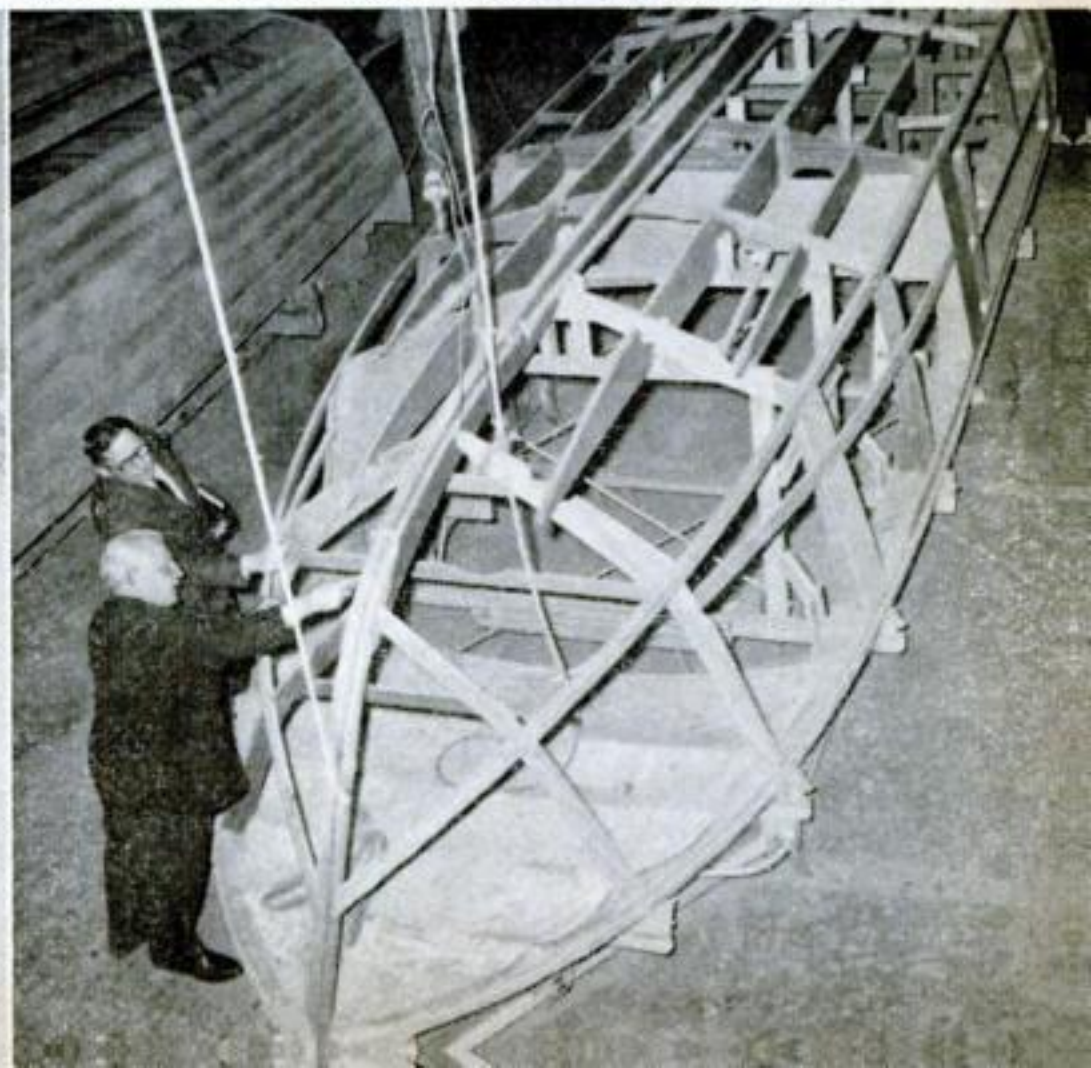
Out back, stern-drive unit lifts clear of underwater obstructions, or for beaching. A touch of a cockpit button operates its hydraulic mechanism. Steering is just like an outboard.

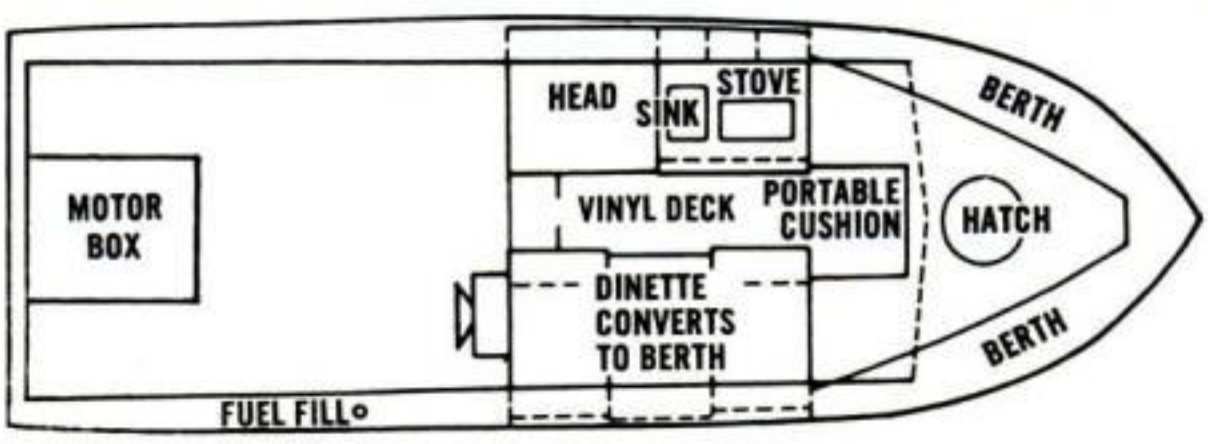
Handles Like Outboard

Beefed-up transom has muscle to handle the thrust of the big power plant. Full-height, it gives extra safety in following seas. Stern drive has single-hole, through-transom mounting.



A husky frame is underneath a skin of five-ply marine plywood. Experienced boatbuilders select the woods for the Princess with care, making certain that each boat is solidly built.





Lots of room inside the Princess: As the floor plan at left shows, there's ample space for sleeping four in the berths forward and in the convertible dinette. There is full headroom in the main part of the cabin—quite a feat for a 24-foot boat. There's a head and galley (sink, stove, icebox)—even a bow hatch.

to starboard. It contains steering and single-lever controls, tachometer, oil-pressure gauge, water-temperature gauge, ammeter, and buttons controlling horn, lights, bilge pump, bilge blower. A separate switch controls the power tilt.

Berths for four. With all the room out back, it's surprising to find so much still left as you move forward. Through the bulkhead door you'll find the dinette. It seats four, converts to a berth to sleep two. Forward of this are two berths and a bow hatch. Moving back on the port side of the cabin, you see a sink, stove, and icebox. Just forward of the bulkhead is a fully enclosed head.

Below deck this craft is also well equipped. She has a 48-gallon galvanized fuel tank; her 12-volt electrical system is fully fused; a plastic tank holds 20 gallons of fresh water; the fuel shutoff valves are easily accessible through a plate in the center of the rear deck; all through-hull fittings have sea cocks.

Building the Princess. To see what holds all this together, I watched the flagship being built. From the time you first pass the tall stacks of mahogany in the outer yards, you have the feeling you are in the presence of people who know how to build sturdy boats.

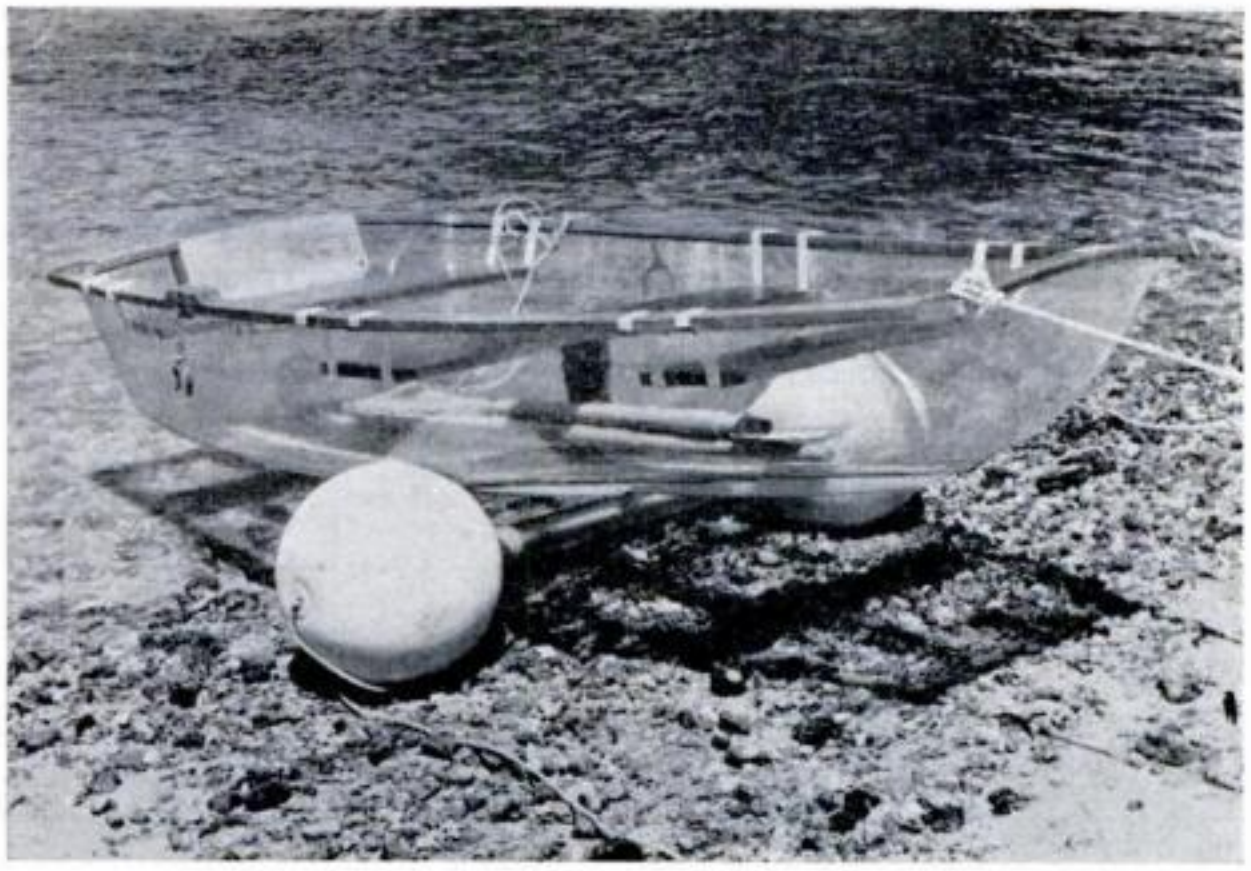
The Princess is an all-wood boat. Her hull bottom is of five-ply Duraply ½-inch thick; the sides are ⅜-inch thick. The outer surface is a phenolic-resin-impregnated wood fiber.

All the engines in the Owens line are fully tested in their engine shop. When installed in a hull, each one is ready and eager to go.

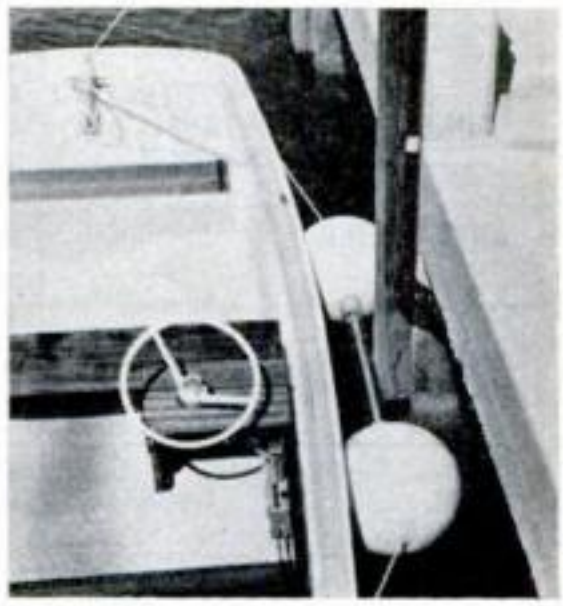
Craftsmanship and attention to detail are apparent at every step, right through to the final sanding and multiple paint jobs. For these, each boat moves slowly through a 400-foot-long heated drying oven four times to dry and harden successive coats of paint and varnish.

The result is a boat that can make a fisherman's life complete, or be the best friend of a family. Obviously, no one recommends a 24-foot cruiser as the ultimate in carefree sailing in really rough water. Nevertheless, the Princess is a tough and rugged lady, and from my experience in seeing her built and handling her in Chesapeake Bay waters, I'd say she could take you out and bring you in again with the best of them. ■ ■

Urheberrechtlich geschütztes Material

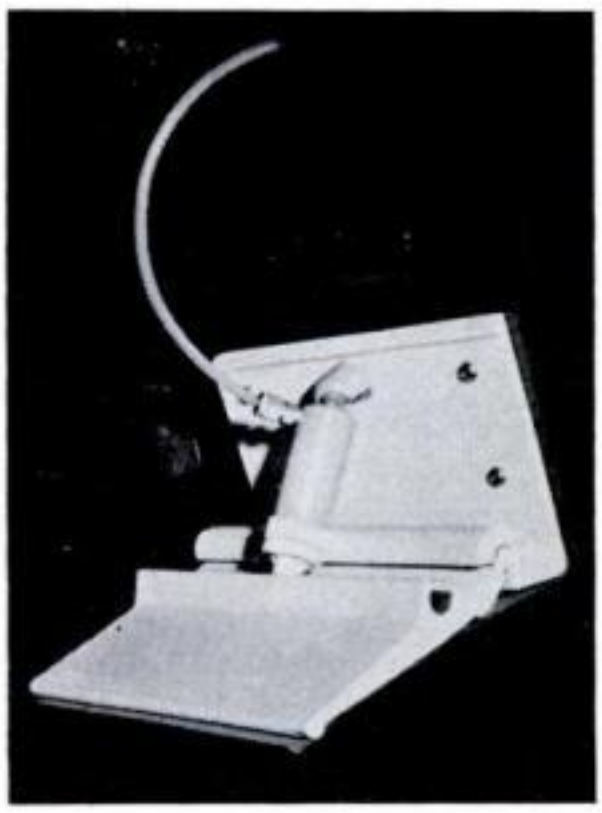


what's new in BOATING



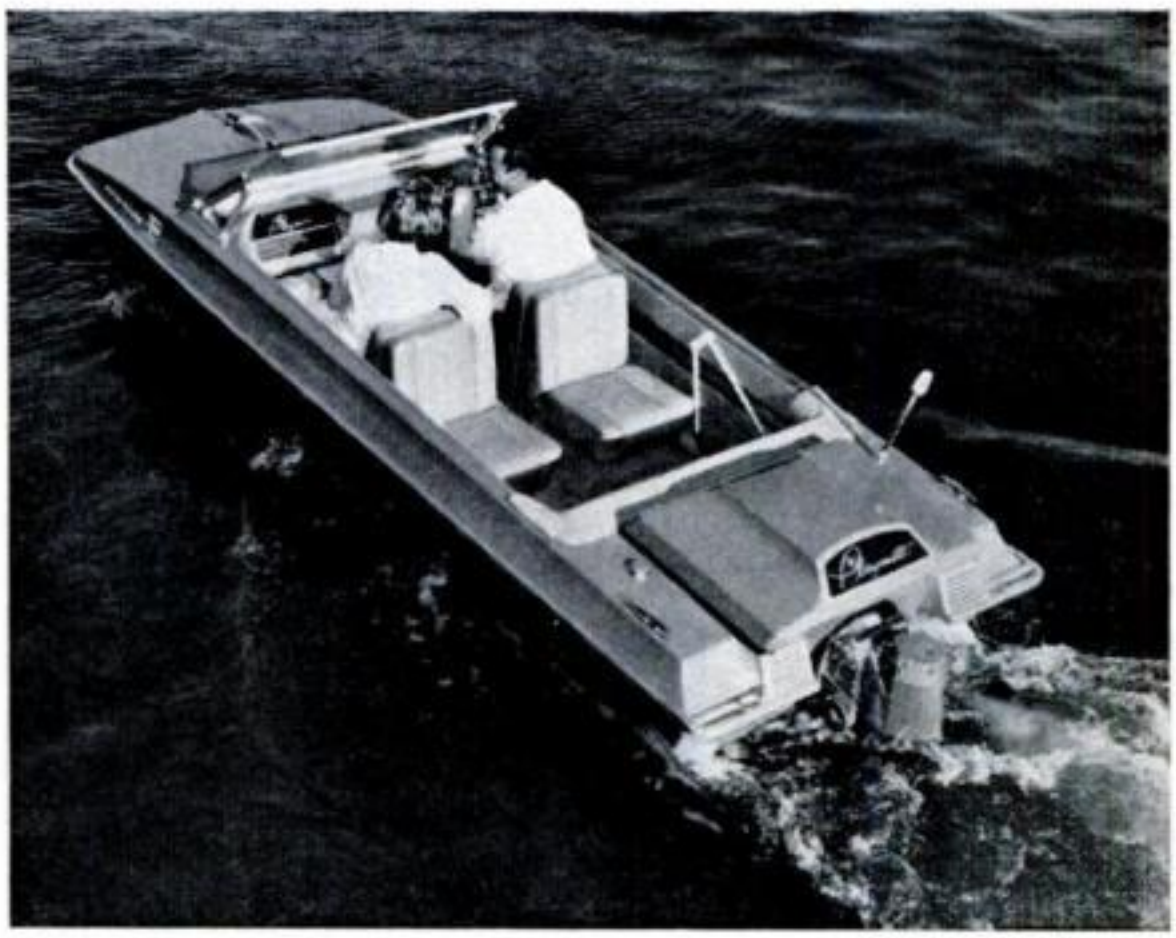
Fender Becomes Beaching Roller

Latest thing for protection of a hull is a combination fender, fender board, and beach roller. This dumbbell-shaped accessory protects a craft of any size from wood or concrete pilings, bulkheads, and seawalls. It is easily stowed behind seats or forward in small V-bottom hulls. That is not the end to its uses. It can serve as a close-up stern tow rig, as a roller for hauling small craft up on the beach and to and from a trailer, and as a floating spacer that can be placed easily between boats. Marina Products of Fort Lauderdale, Fla., is the maker.



Trim tabs slash planing time by 15 seconds

More boatmen are longingly eyeing hydraulic trim tabs. In a test of a pair of these nine-inchers, on a 20-foot lapstrake with four persons, the time to optimum planing attitude was cut from 20 to 5 seconds. Tempo Products, Cleveland, Ohio.



Glamor girl joins the Evinrude fleet

A runabout that the manufacturer likes to bracket with expensive sports cars in its appeal to youth is Evinrude's Playmate. Tagged the "glamor girl" of the company's gull-wing hull designs, it measures 14 feet, 7 inches overall, and is powered by a 90-hp. V-4 stern-drive engine. The top speed is 40 m.p.h. The cockpit is an eye-catching red and the boats—in limited production—will bear a plate engraved with the name of the owner. Price: $2,995.

Urheberrechtlich geschütztes Material

The POPULAR SCIENCE Guide to Boat Finishes

KIND OF PAINT	CHARACTERISTICS				SPECIAL TREATMENT REQUIRED			
	ANTIFOULING QUALITIES	ABRASION RESISTANCE	SLIP	COLORS	BARE WOOD	REPAINT	ALUMINUM	GLASS
ANTIFOULING	Excellent	Poor	Fair	Limited range	Self-priming	Sand to smooth and scarify	Special primer	Epoxy primer
ANTIFOULING HARD BOTTOM	Good	Good	Good	Wide range	Flat undercoat	Only over old hard finish	None	None
VINYL	Good	Good	Good	Limited	Self-priming	Remove old finish	Special primer	Epoxy primer
EPOXY COATING	None (Generally used as a bottom finish in fresh water only)	Excellent	Excellent	Wide range	Epoxy coatings work generally on all surfaces, but the all-epoxy system should be used over bare substrate			
HARD RACING	None	Excellent	Excellent	Wide range	Flat undercoat	Sand. Only over hard finishes	Special primer	Epoxy primer
VARNISH—ALKYD AND PHENOLIC	None	Good to excellent	Excellent	Colorless	Self-priming or use clear seal	Sand to smooth and scarify	Not used	Not used
URETHANE	None	Excellent	Excellent	Colorless	Urethanes need a tooth to cling to; excellent over bare wood, or for repaint if old coat is scarified			
BOOT-TOPPING AND ENGINE	Most desirable characteristic is gloss and dirt resistance. Hard antifouling enamels can be used in problem waters as a substitute				As engine enamel, is easiest to use in spray cans			

HOW TO PICK THE RIGHT

PS MATERIALS

Boat Finishes

By Jackson Hand

FEW of man's possessions take a bigger beating than a boat—or more kinds of beatings. Mostly outdoors, sometimes wet, sometimes dry, exposed to punishment from the sun, and subject to flexing and strain, a boat needs quite a finish!

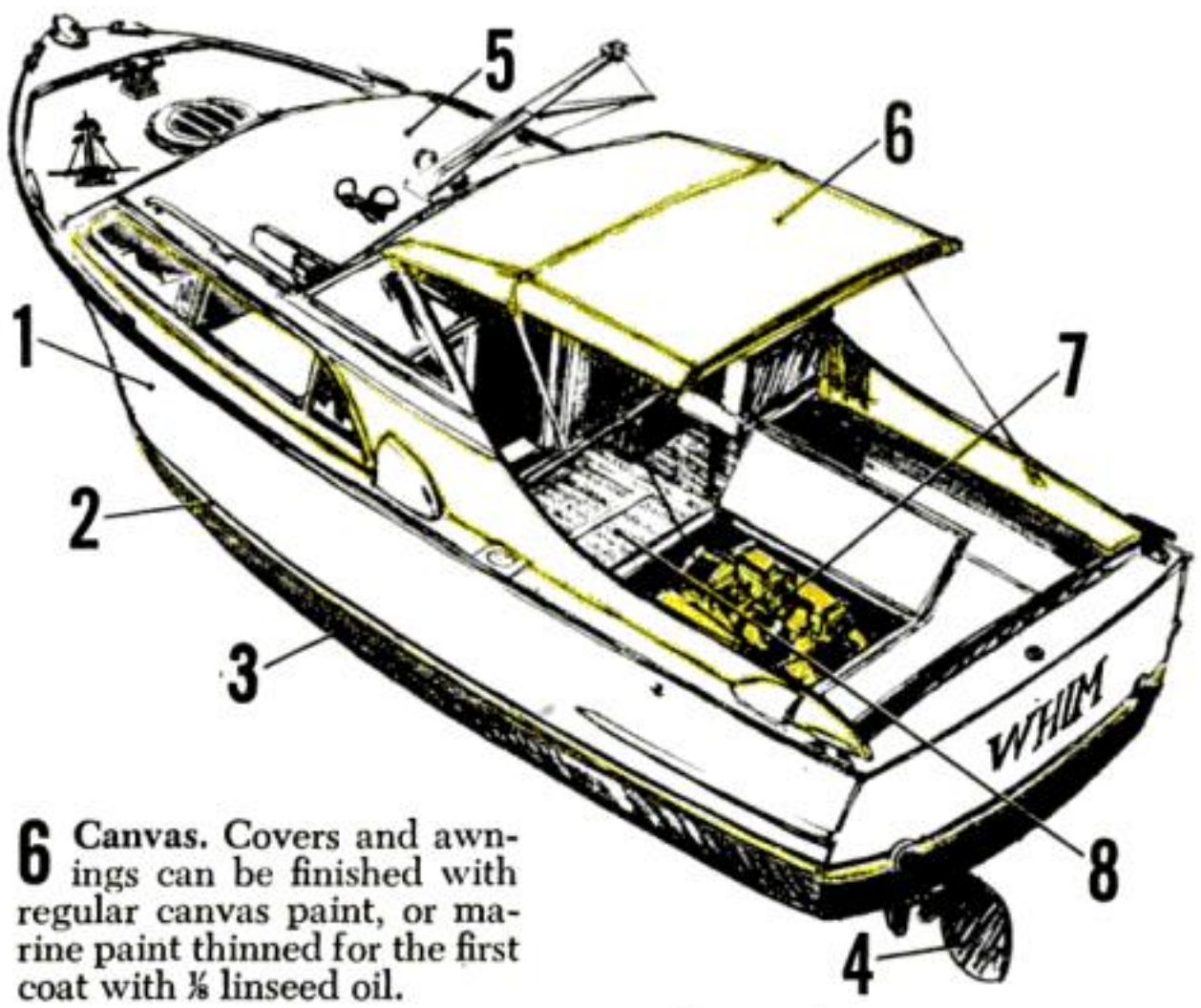
That's why good boat paints are better than the run-of-label materials you use around the house, why they contain ingredients never found in ordinary finishes—and why they cost more.

Bottom and top paints differ. The part of a boat in the water is called the *bottom*, no matter how far up the sides the waterline may come. The rest of the craft is *topside*. The line between wet and dry all around the boat—while it is standing still in calm water—is the *boot top*.

You need a different paint for each of

Urheberrechtlich geschütztes Material

WHICH PAINT GOES WHERE



1 Topside. Use marine paint or enamel for very small craft. Larger boats call for paints that chalk or erode so repainting will require minimum preparation.

2 Boot top. The material you use here need not be antifouling. But it should be glossy and hard so surface scum accumulated while at anchor can be washed off.

3 Bottom. Antifouling material here, but you must balance slip (antifriction) with fouling. Consider also need for trailering, not compatible with antifouling.

4 Underwater metal. This presents corrosion problems from electrolysis. Use 6-mil barrier between copper-type antifouler and steel.

5 Deck. Here you can use marine enamel. Since you may slip on glossy surfaces, look into abrasive materials to stir into regular paint.

6 Canvas. Covers and awnings can be finished with regular canvas paint, or marine paint thinned for the first coat with ⅛ linseed oil.

7 Engine. Prevent rusting and corrosion with engine enamel (or coatings intended for both engines and boot top). Use spray cans.

8 Interior. Where weather is no factor, use semigloss or flat enamels. Many marine finishes come in surfaces ranging from gloss to flat.

PAINT FOR THE JOB

these parts. (Actually, you may decide that it's too much bother for a very small boat you take out of the water when not in use.)

Bottom paint is most critical. Pick it for antifouling properties, for antifriction properties—or a combination of the two.

An antifouling paint contains copper or mercury or tin or some other material that discourages or poisons plants and animals that may fasten themselves to the bottom.

Most paints formulated mainly for antifouling qualities are quite soft. They rub off on a trailer. They cannot be beached on rocky shores. Most of them, too, must be kept wet.

Some antifouling paints will dry out and flake off in a week or two out of the water. This is a deliberate part of the formulation, to make repainting easy.

The spare time you have for painting your boat is an important factor in selecting an antifouling paint. Some coatings must be put in the water within a few days after they are applied. In many cases it is best if you launch the boat as soon as the initial skin forms on the paint—you must schedule painting and launching for the same weekend. Some of the newer formulations, including those with tin as the antifoulant, can be put on well in advance of launching.

Because antifouling paints are soft, most are not considered "fast" in the water. When low friction between boat and water is critical (for racing or fuel economy, say) and when frequent hauling isn't feasible, boat owners in fouling waters turn to a finish known as antifouling hard racing. This fairly hard and smooth finish resists

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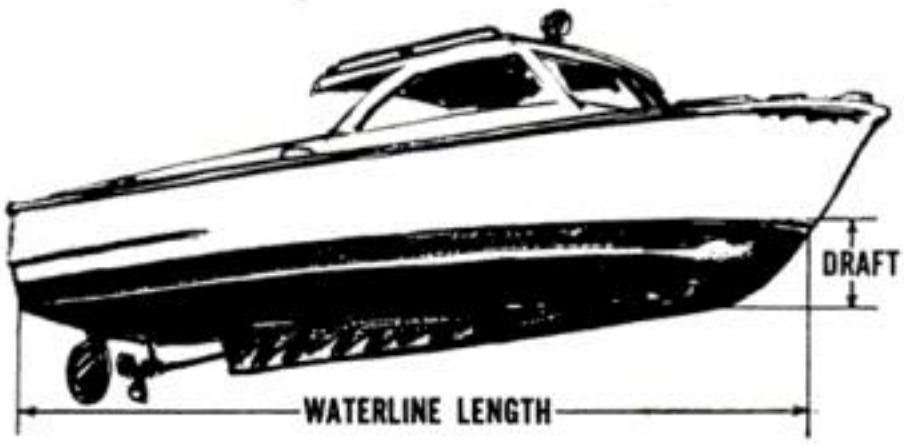
Urheberrechtlich geschütztes Material

How Much Paint Do You Need?

The four formulas given here will tell you the gallonage of paints required for most boat-painting jobs. All formula dimensions are in feet.

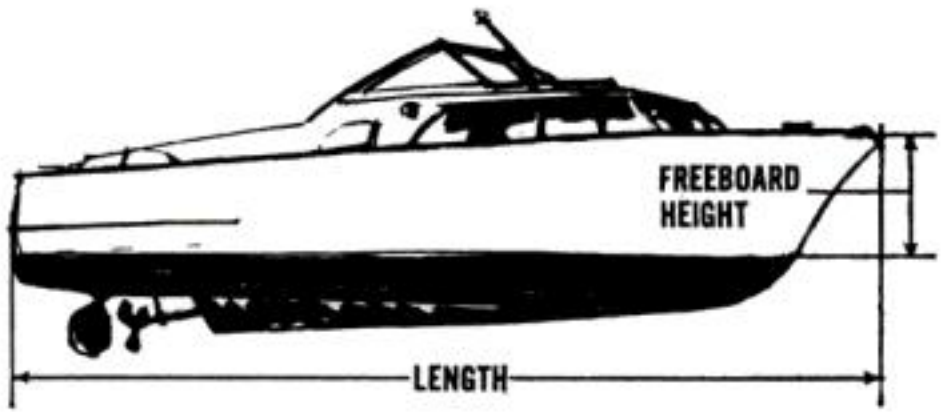


Bottom Paint

3.25 x length at waterline x draft

300 for antifouling primer
400 for antifouling recoat
500 for varnish or recoat enamel
750 for varnish recoat

EXAMPLE: $\frac{3.25 \times 18 \times 4}{300}$



Topside Paint

1.5 x length x freeboard height

325 for primer
500 for varnish coat or enamel
750 for varnish recoat

Take the indicated measurements from your boat, drop them into formula where they're

fouling because it contains (usually) mercury. Mercury is not as effective as copper, but it has the advantage of working in hard-setting formulas.

Antifouling properties are now being offered in epoxy-type paints, too. Read the labels carefully, since not all of them are usable over all types of construction. Their performance is best on glass hulls.

Most often, when a man races small craft seriously, he pulls his boat out of the water after every event. Fouling is no problem, and a regular hard racing bottom paint is the usual choice.

A hard racing bottom paint is basically a high-quality enamel—hard, tough, glossy. You can trailer a boat with a hard bottom, beach it, drydock it. The hard racing formulas are the natural choice of freshwater sailors, except in waters where slime accumulates fast and creates a problem for boats too heavy to haul out four or five times a season. Antifouling hard racing paint is the choice.

New plastic coatings are growing in importance. Acrylic, vinyl, urethane, and epoxy (both two-can and one-can formulations) have the same advantages on a boat as they have everywhere else: hardness, resistance to chipping, and ultra-smoothness.

Clear finishes for bottoms. These are not ordinarily used on boat bottoms in fouling waters, and in recent years have begun to disappear even in fresh water. More and more, a boat is painted below the splash rail although it may be varnished above. The reason: There are no clear finishes that will equal pigmented finishes on all counts. But there is nothing to keep you from using varnish on a wooden boat if you like the looks.

Boot-topping paint is used in a stripe all around the boat, right at the waterline. The width of the stripe varies, but it is usually not less than two inches. It serves an interesting purpose.

It is not bottom paint—part of it may lie out of the water when the boat is at anchor, and it might flake off. Nor is it topside paint, since it's subject to exposures abnormal for topside. It is not antifouling, since marine growth doesn't like to lodge near the surface.

What boot-topping paint must be is hard and shiny and washable. As the boat lies at anchor, all manner of surface scum and other flotsam come in contact with it. The boot-topping paint must withstand this on-

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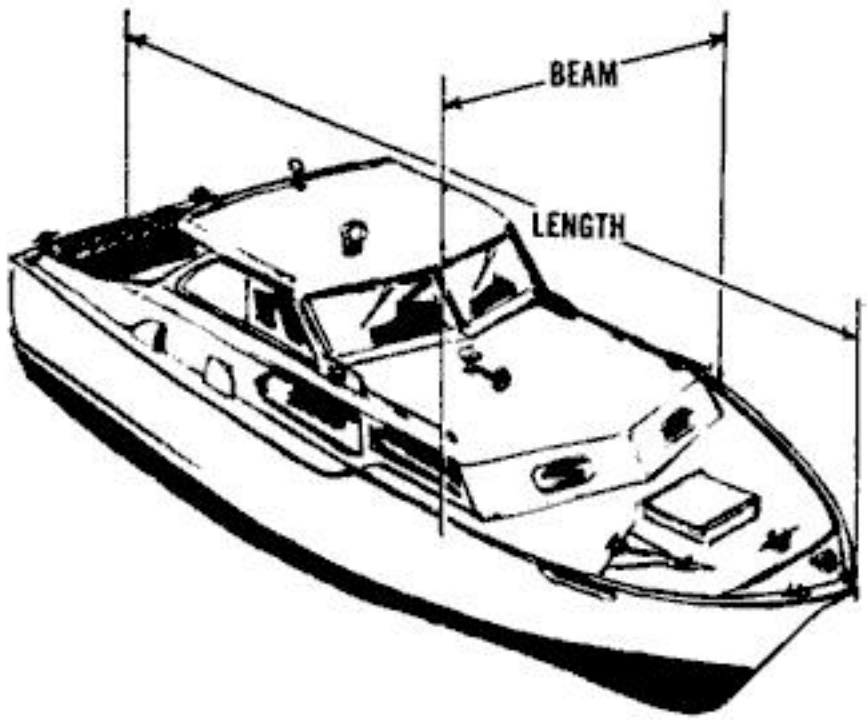
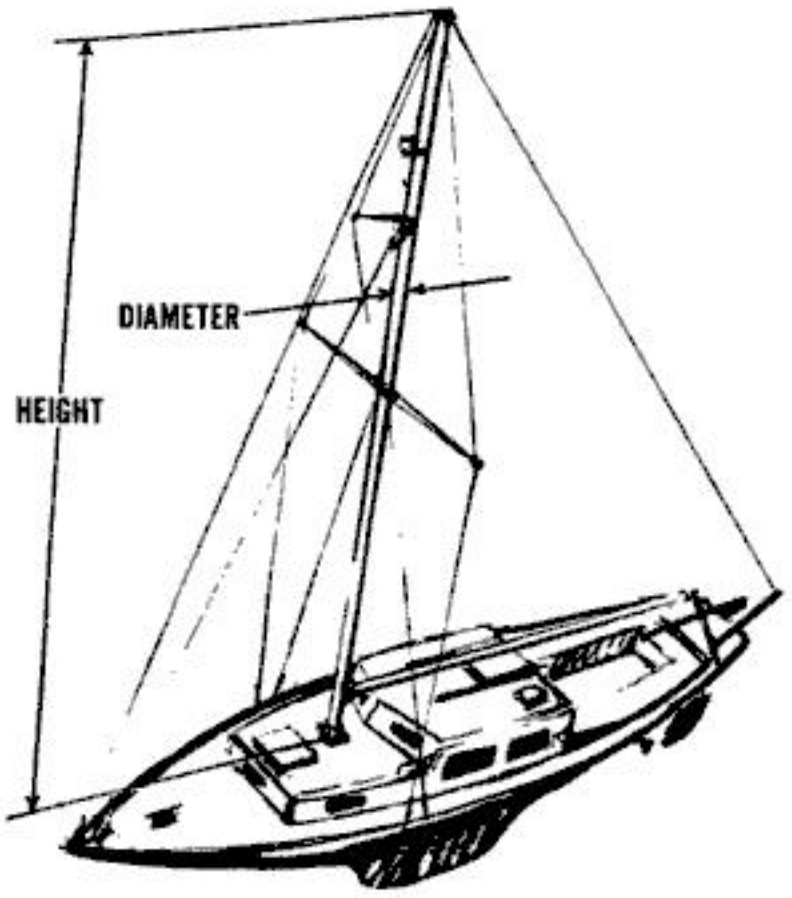


Deck Paint

.75 x length x beam (less cabin, cockpit, etc.)

325 for bare wood
500 for enamel recoat or varnish
750 for varnish recoat



Mast and Spars

2.5 x diameter x height

500 for varnish first coat
750 for varnish recoat

called for, multiply and divide as shown in example. Result: approximate gallonage needed.

slaught and slough it off. The choice: a good hard racing bottom paint.

Topside paint has the easiest job. The usual name for topside paint is marine paint. You can buy it in gloss, semigloss, or flat and use it anywhere above the waterline. Many paint makers don't even differentiate between this paint and deck paint. It should include fungicides to fight off mildew.

Many boat owners look at the topside as home owners look at a house. They use gloss paints where wear and handling are greatest. They use semigloss inside cabins. They may use flat on large hull areas of a big boat. They expect this hull paint to weather over a period of time to minimize preparation for recoating.

Spar varnishes for brightwork. Most boat owners hate keeping the brightwork—varnished spars, trim, etc.—looking decent. It means sanding and revarnishing once a year. Only rarely can it go two seasons.

One thing that will help: Buy a spar varnish that has phenolic resins, which many experts believe are better than alkyds for marine work.

Another: Insist on ultraviolet inhibitors in the varnish. Most damage to clear finishes is caused by the ultraviolet rays of the sun.

A third: Look into the urethane and epoxy coatings. These may require complete sanding to the absolute bare wood, and they may need special all-epoxy or other systems. But their promise—although they are new—is for greater life and better all-around performance.

Special primers and systems. Painting a boat above the waterline is like any other painting: proper preparation, proper application. Below, there are differences.

It is always wise to use the entire system of a particular manufacturer. If a marine finish calls for a primer made by the company that made the finish—use it. Remember that the best system over wood is not the same as the best system over glass—or aluminum. Plywood requires special priming to cut down checking.

Most important: When you see an antifouling bottom paint, don't forget the extreme corrosion problems that can arise when electrolysis sets in between the copper and aluminum or steel. There are carefully formulated and specific barriers that must be used in such cases, and it is disastrous to ignore them. ■ ■

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PS ELECTRONICS

How Good Is the New Breed of COMPACT SPEAKERS?

PS rates six new low-cost, high-quality loudspeakers of pygmy size

By Hubert Luckett and C. P. Gilmore

GOOD loudspeakers used to be as big as doghouses. Now some are as small as birdhouses. But how good are they?

To find out for you, we checked out a half-dozen pairs of the new crop of small speakers. The answer: astonishingly good. And—those smaller cabinets come with smaller price tags. The six speakers we tested run from about $43 to $70. With discount prices—widely offered on some models—you can now get a pair of good speakers for stereo for less than $100.

To be honest, they won't match the performance of many of the more expensive speakers. The principal difference comes in the deep bass range—organ pedal tones, for example. For comparison during the tests, we switched in a $225 AR-3 with excellent low-frequency response. There was a striking difference. The really low bass tones are the most expensive to reproduce.

On other types of music—even full orchestral passages—the difference was far less striking. And while the bass response of

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All listening was done blind; the speakers were identified only by number, and the judges didn't know which ones they were hearing until they made their choices. Main surprise: the high overall quality.

these new cheaper speakers isn't up to that of the costlier jobs, we think all but the fussiest listeners will be happy with them.

Most cheap speakers previously available had glaring faults. Some were screechy or harsh sounding. Others were seriously shy of bass or treble, or had noticeably uneven frequency response. Not one of the speakers we tested suffers from these defects. Some are better than others, but all produce a pleasant, listenable sound.

The sound's the thing. In a speaker, it's the sound that counts. Response curves and other measurements are useful mostly to engineers. A speaker designer can spot deficiencies with instruments and tell if changes he makes are curing the problem. But curves don't really tell how speakers sound.

Since speakers must be judged primarily by ear, a lot of myths have grown up around them. The most persistent one is that choosing a speaker is entirely a matter of taste: For some mysterious reason, I like speaker A; you prefer B. Since there are no standards to go by, the trick is to find one that

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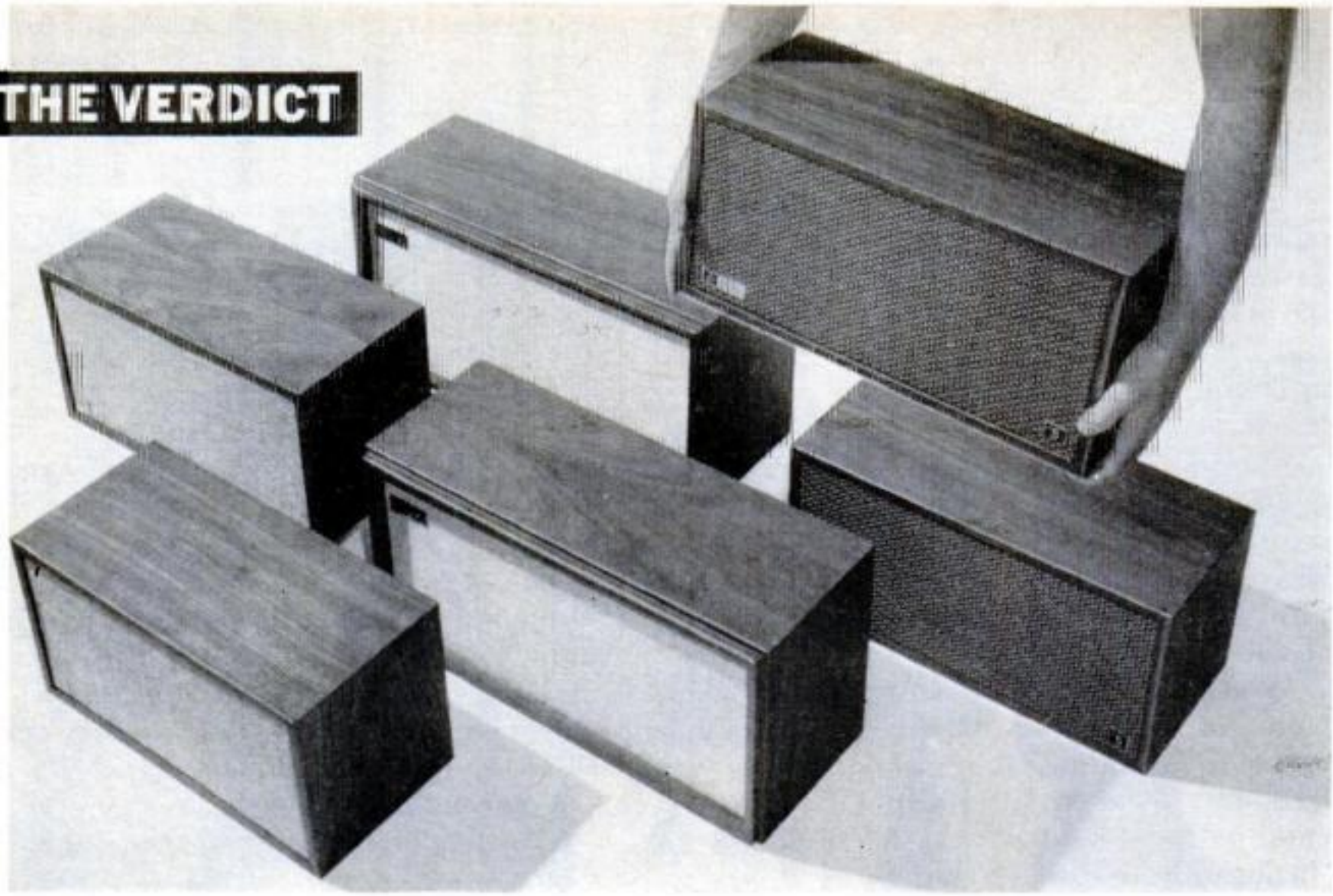

Top-rated speakers, the AR-4 (pair shown at left), KLH Model 17 (center), and Fisher XP-5 were judged to have slight edge over the others. Fisher and AR use eight-inch woofers (low-frequency speakers); KLH (in largest cabinet of group) has 10-inch woofer. Because of extremely small differences in sound quality, Fisher (the cheapest) was judged the best buy.

fits that elusive thing—your personal taste.

But buying a speaker isn't like choosing a suit or picking the color of a new car—an esthetic thing. A speaker is a machine, designed to do a certain job. The one that does the job best is the best speaker.

That job is to reproduce the original sound of the music. The ideal speaker would reproduce all sounds equally, from highest to lowest. It would be completely "colorless," producing only the sound of the music, adding nothing of its own. Of course, there is no perfect speaker. Practical units differ, though, in the nature of their shortcomings. But while some speakers miss perfection by a wide margin, others come very close.

Taste plays a part only when two speakers are roughly comparable. Then you must decide between slight differences, settling for the imperfection you'd rather live with. But if—say—one speaker definitely alters the original sound less than the other, it is the best speaker. Taste has nothing to do with it.

The test setup. We did our listening in two rooms to make sure that acoustics did not affect the results. The first series of tests was made in a 15-by-16-foot study with bookshelves on several walls, a carpet, and upholstered furniture. Acoustically, it is a fairly "dead" room. After the first tests, the setup was torn down and reassembled in an 18-by-36-foot living room. Although carpeted, the room is quite "live." Our experts reached the same conclusions in both rooms, but noted that differences in speaker performance were emphasized in the large room. In the small room, the speakers sounded more alike.

Each judge listened individually. When he entered the room, six pairs of speakers were lined up at one end. At the listening position were a turntable and stereo amplifier. The speakers were connected to a six-position switching network, so any pair of speakers could be connected to the amplifier instantaneously. The speakers were identified only by number; the listener did not know which speaker was connected to which switch position.

Each panel member spent his time—usually several hours—switching from speaker to speaker, listening to many kinds of music: orchestra, opera, piano, guitar, percussion, solo instruments. When he had reached definite conclusions, he left the room. Then the speakers were juggled to other switch positions and the judge returned to do it

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all again. The mix-up routine was repeated several times to make sure judges would consistently reach the same conclusions about each speaker, no matter where each appeared on the switch.

The results. Three speakers were unanimously judged to have an edge over the others. The top-rated models (in order of descending price) were the KLH Model 17, the AR-4, and the Fisher XP-5. The KLH and Fisher sound were astonishingly similar in character. The AR's was somewhat different.

Some judges liked the KLH-Fisher sound quality best; others preferred the AR. But the difference in quality among these three was judged inconsequential. "I wouldn't turn around for the difference between any of them," said one judge.

What were the differences? The AR had more of what high-fidelity experts call "presence"; middle-range sounds (from violins, say) seem to be closer to the listener. One judge described the KLH sound as "beautifully unforced and natural." The KLH also seemed to have a slightly cleaner, tighter sound in the lower midrange. It took a lot of listening, however, to spot the difference.

On the basis of these results, the Fisher at $54 would be a "best-buy" selection. Before you decide, however, check into local prices. Discounts are usually available. And you may have a slight preference for one of these three over the other two. If so, get it. There's not a bad buy in the bunch.

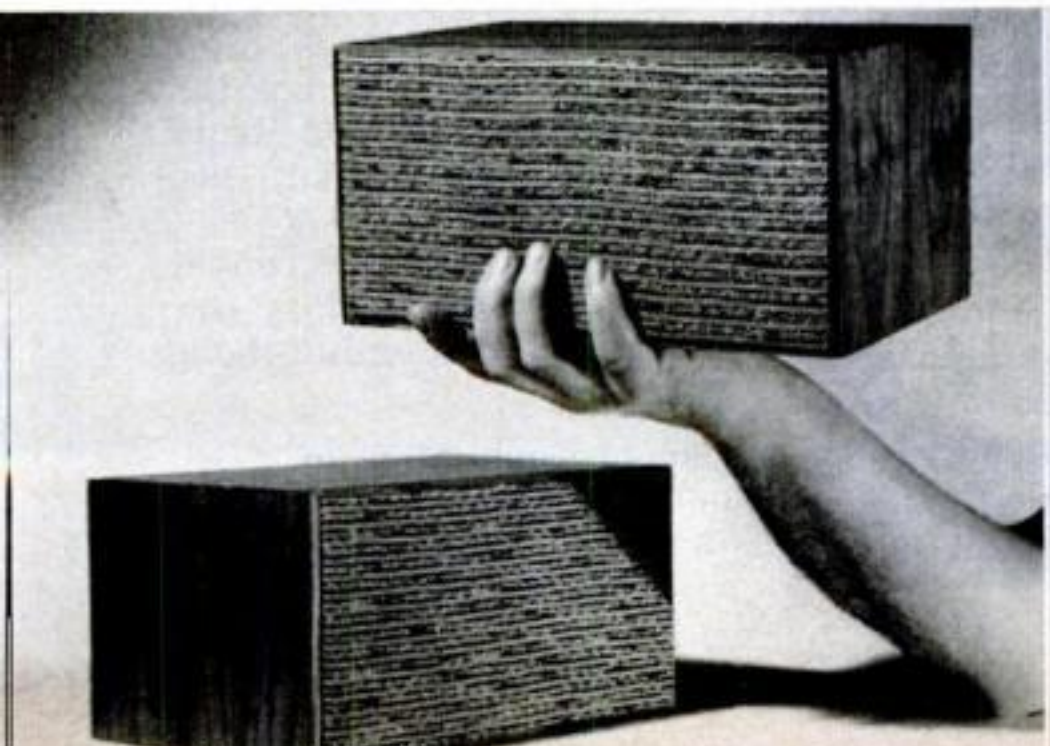
The next group of speakers—the Scott S-5 and Sonotone RM-1—were rated slightly behind the three leaders by all panel members. In general, they hadn't quite the same low-frequency response; the bass wasn't quite as solid. The Scott sound was characterized by one judge as "very bright and transparent." In the Sonotone, the highs were "a little peaky." Both speakers, nevertheless, were quite pleasant sounding.

Classified according to size, the three models given the slight edge—the KLH, the AR, and the Fisher—turned out to be the largest. Front panels averaged about 10 by 20 inches (the KLH is 23 inches long). The AR and Fisher use an eight-inch and the KLH a ten-inch speaker. The Scott and Sonotone use six-inch speakers, and are housed in smaller boxes—about 10 by 15. (All sizes given are for the woofer, or low-frequency speaker. All units also have high-frequency tweeters.) Since all the speakers produced pleasant sound, the choice could boil down to this: Do you want a slightly better sound, or a slightly smaller box?

A special-purpose speaker. One speaker tested did not really fit into the same size or performance category as the other five. The Goodmans Maximus I was by far the smallest of the lot—hardly bigger than a cigar box. The amazing thing is that the designers managed to get anything worthwhile at all out of it.

The upper- and mid-ranges of the Maximus I are smooth and pleasant. But its bass response simply isn't in the same class as the other speakers'. The Maximus I is designed to be played with the bass boost on the amplifier turned up. This helps, but it still doesn't have the low-end response of the larger units. Nevertheless, if your space is severely limited, the Maximus I may be a logical choice. ■ ■

If space is really tight, the Goodmans Maximus 1 (hardly bigger than a cigar box) may be your best bet. Its bass response isn't as good as the others', but overall sound quality is pleasant and listenable. Low-frequency speaker in these units is astonishing 2¾ inches in diameter.



Differences were small, but Sonotone RM-1 (left) and Scott S-5 were judged not quite so good in low-frequency response as top-rated three. But both have one advantage: Their six-inch woofers allow significantly smaller cabinets (five to eight inches) than the others.

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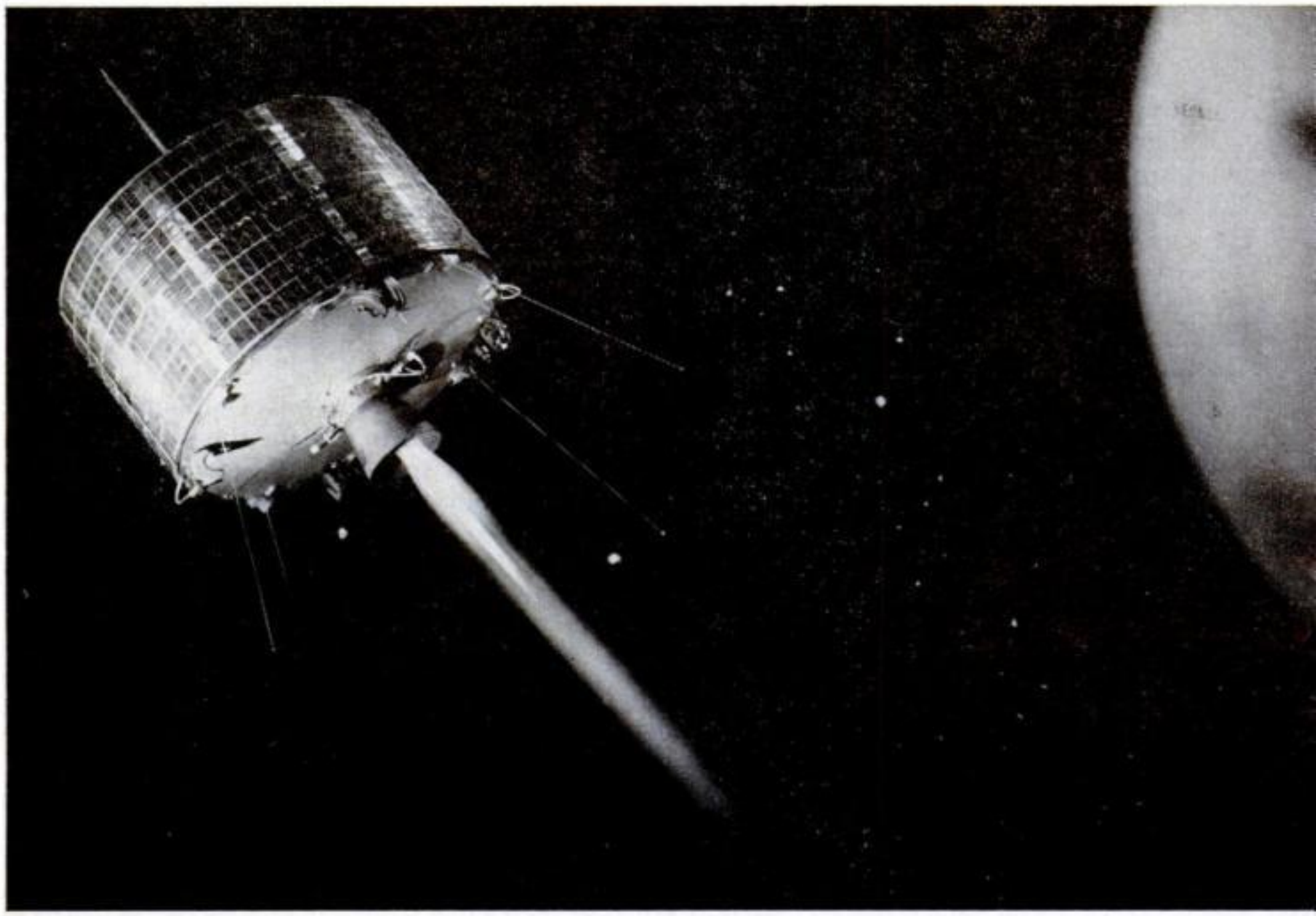

Syncom goes into orbit for camera

Assigned to show how the Syncom satellite would look orbiting 22,300 miles from the earth last October, while transmitting TV pictures of the Tokyo Olympics around the world, Cape Kennedy photographer Bob Special came up with the view above —actually a triple exposure. He used the same film in three cameras equipped with ground-glass viewers. His props were a NASA scale model of Syncom, a lighted

New tag-along camper

This camper fits around, not on, the little panel Minivan that hauls it. The British combo sleeps four—two in a three-sided box that goes on top of the truck. An inverted 9½-foot boat makes its roof.

A separate trailer on its own two wheels slips over the box-boat assembly, being

Camper and Minivan are only 15½ feet long for travel. Panels hugging sides are doors.

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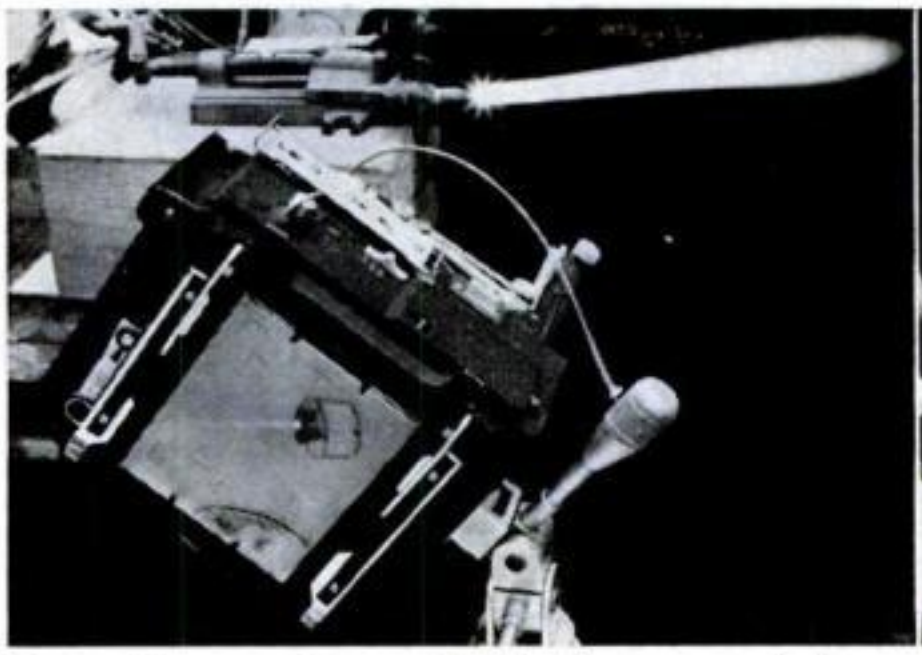
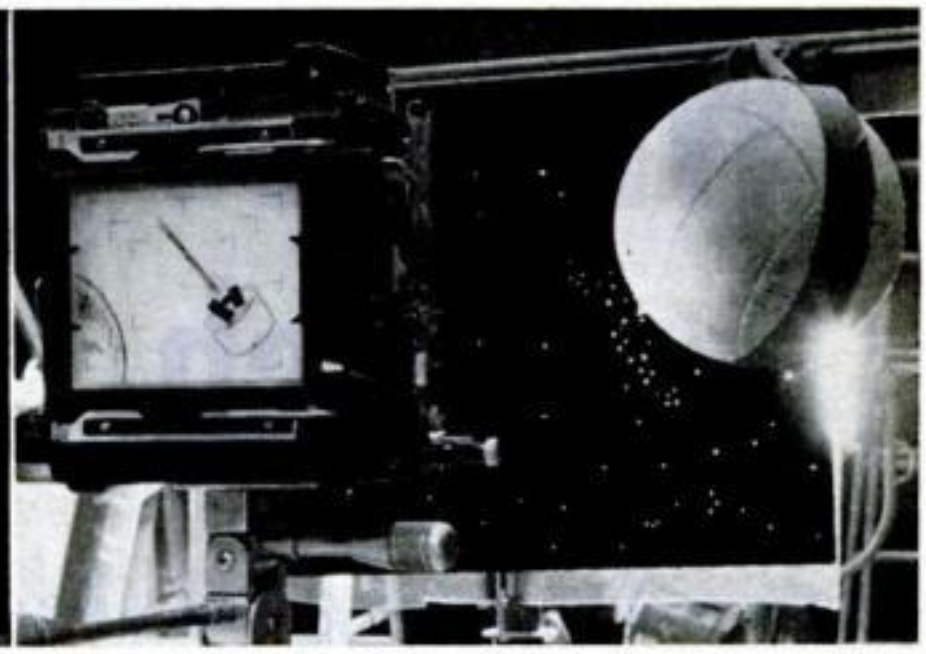
In setup for taking photo at left, Special is behind camera No. 1 that made first shot of suspended Syncom model. Camera No. 2 is focused on torch for a second picture, while third is trained on ball.



Parts of composite are sketched on ground-glass viewer so flame of torch can be lined up accurately to simulate the satellite's exhaust.



Third camera is focused on perforated cardboard background and volleyball earth. Double strand of wire over lens diffuses the stars' light.

acetylene torch for the satellite's tail, a volleyball for the earth, and a sheet of black cardboard punched with holes and lighted from behind for stars in the sky. Steps in shooting the composite photograph are shown in the pictures above.

In six years at the Cape, Special has produced realistic in-flight portraits of almost every satellite *before* it was actually launched, beginning with the weather satellite Tiros in 1960. As each new spacecraft arrives at the Cape, he checks with scientists to get a firsthand understanding of how it will look in orbit. Then he goes to work with his gimmicks and battery of cameras and lights.

rolls with truck

aligned by two guide shafts under the floor that slide into tubular sockets. A crank at rear operates a screw engaging a threaded tube under the truck floor.

The main living quarters include a second double bed, cupboards, and galley. They open to the roof-top bed and luggage in the van's body.

Unshelled of trailer, roof-top bunk, and boat at campsite, truck is freed for use alone.

Urheberrechtlich geschütztes Material

PS ELECTRONICS

Build Your Own "Wireless" Tach

This tachometer is different: It reads engine r.p.m. without any connections to the engine

By Ronald M. Benrey

HERE'S a portable automotive tachometer that's as easy to use as a transistor radio; just switch it on and read the revs. It has two ranges: 0-1,000 r.p.m.—perfect for adjusting a carburetor at tune-up time; and 0-5,000 r.p.m. for high-speed tests.

The best part is that there are no leads to connect—no wires to hook up to the engine. All you do is place the tach's pick-up probe near the engine's spark coil. The tach will work with any kind of ignition system, including transistor ignitions and systems without breaker points.

Want one? They aren't available in parts shops, but it's easy to build your own. Time: one or two evenings. Total cost: about $30.

How it works. The key to its operation is magnetism. The tach counts the sparks generated by the engine's spark coil and converts the number of pulses per second into an r.p.m. reading. The number of sparks per second is directly proportional to engine r.p.m.

Every time the coil produces a spark, it generates a strong magnetic field that lasts a tiny fraction of a second. The tach's probe picks up these magnetic bursts and produces tiny voltage pulses—one for each time the coil fires a spark. The tach's counting circuitry does the rest.

Transistor Q1 amplifies the tiny output pulses from the probe. Q2 and Q3 form a transistor "switch" that's activated by the pulses. Each pulse turns the "switch" on; it turns itself off automatically in about a thousandth of a second. Q4 and diodes D2 and D3 form a circuit that counts the number of times per second the "switch" circuit turns on and off. The current through meter M1 is proportional to this count, making the meter reading proportional to engine r.p.m. Switch S2 selects either the 0-1,000 or 0-5,000 r.p.m. full-scale range.

The positive on-off action of the transistor "switch" circuit makes the tach independent of temperature—there's no calibration error as the temperature changes.

Also, it makes the exact probe location near the coil noncritical—anywhere within a foot of the coil usually works. The meter

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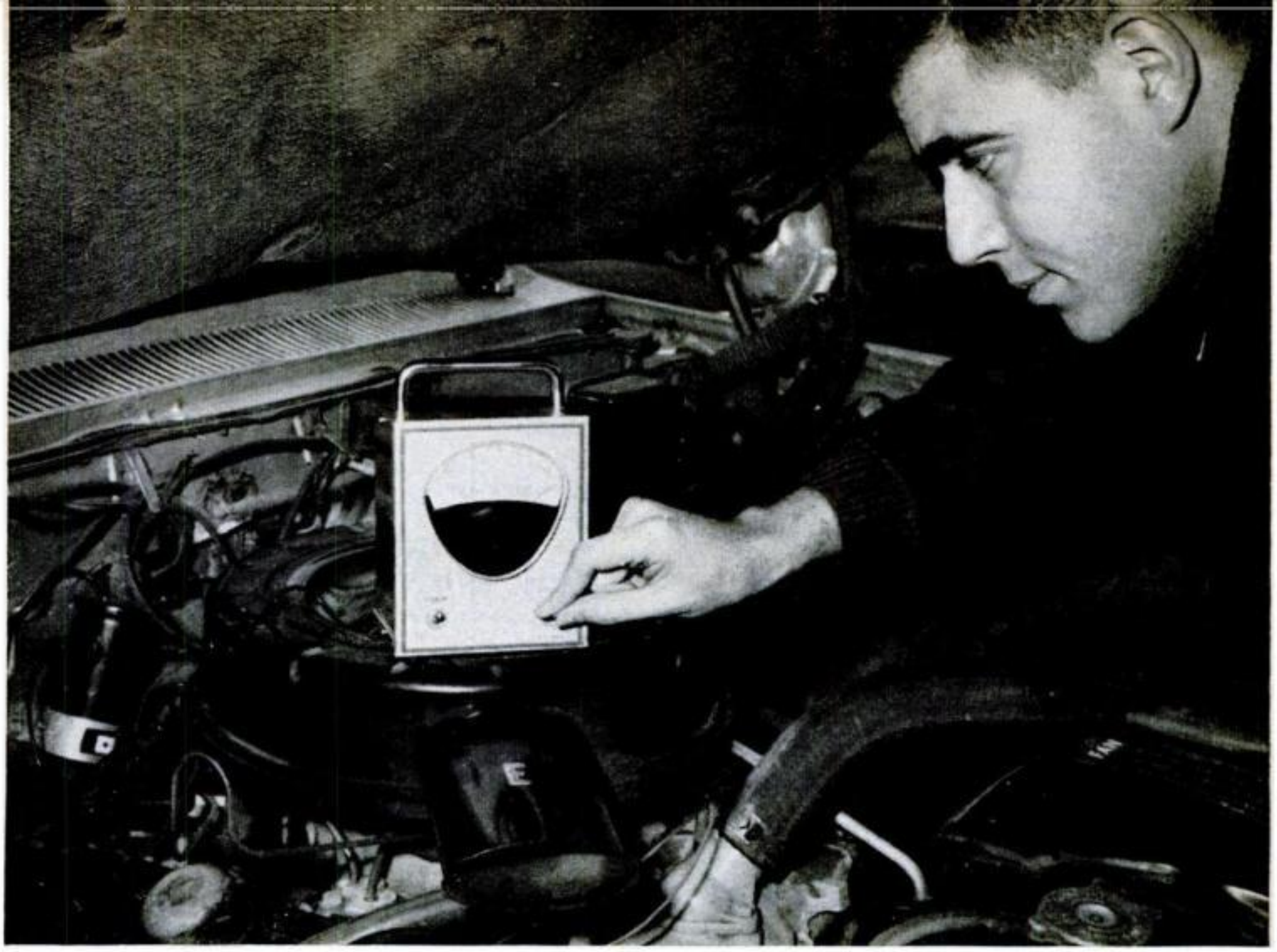

reading may become erratic or bounce off scale if the probe is positioned flush against the coil—this is a sign that the breaker points are bouncing as they close, causing the coil to produce additional magnetic field bursts that confuse the tach circuit. The cure: Position the probe a few inches away from the coil.

Building the tach. An aluminum minibox makes a lightweight, sturdy, and inexpensive case. Add a handle for convenience.

Wire the circuit on a piece of perforated phenolic chassis board (Vectorboard), using push-in terminals (flea clips) as soldering points. Double-check the polarity of capacitor C1 and the diodes before wiring them in place. Grip diode and transistor leads with needle-nose pliers when soldering them in place. The pliers act as a heat sink and protect these heat-sensitive components from damage.

The panel meter M1 specified in the parts list was chosen because it is shockproof and accurate. Any 0-1 ma. DC milliammeter will work in the circuit, although less-expensive units tend to be less accurate.

Cover the meter's 0-1 ma. scale with an 0-1,000, 0-5,000 r.p.m. scale lettered on stiff white paper with india ink.

The power supply consists of eight mercury pencells mounted in holders and wired in series. Don't use carbon or alkaline cells. Mercury cells maintain a constant output voltage as they age; this helps keep the tach accurate without frequent recalibration.

The tach's magnetic probe is a "telephone pickup coil" (see parts list) that is usually sold as tape-recorder accessory to pick up telephone conversations. Buy the type with a built-in suction cup; it's a great help in positioning the pickup near the spark coil.

Calibration. Make a simple calibrator by connecting filament transformer T1 to pilot light L1 as shown in the diagram. When the transformer is plugged in, it has a 60-cycle-per-second magnetic field surrounding it. Use this field to calibrate the 0-5,000 r.p.m. range. Hold the tach's probe close to T1's iron core, and adjust R10 to obtain the meter reading following. The correct reading depends on the number of

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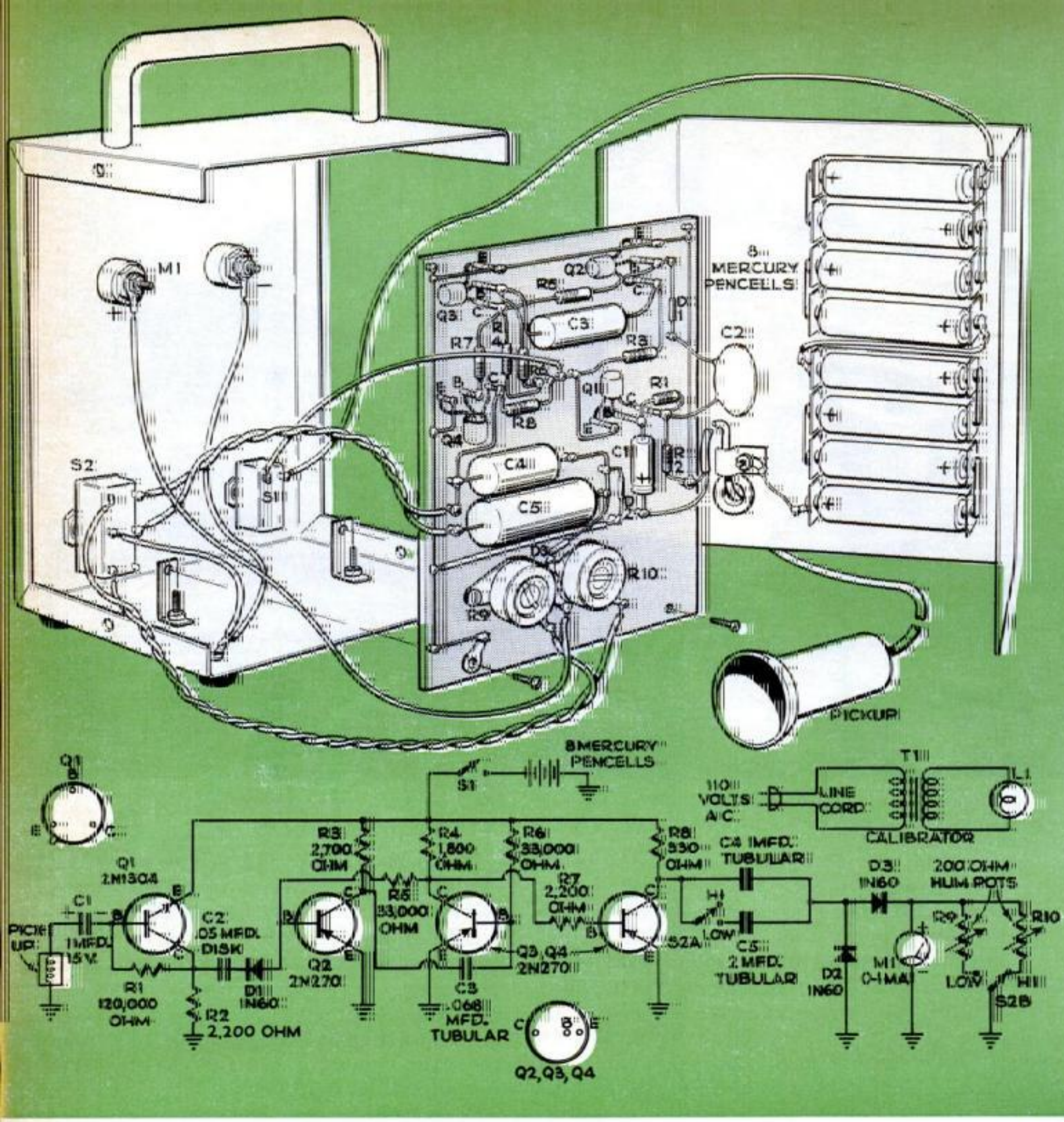
Urheberrechtlich geschütztes Material



cylinders in the engine of your car. Like so:

4-cylinder engine—1,800 r.p.m.
6-cylinder engine—1,200 r.p.m.
8-cylinder engine— 900 r.p.m.

Next, measure your car engine's idle r.p.m. on the 0-5,000 scale. Then switch S2 to the 0-1,000 range and adjust R9 to obtain the same meter reading. Check the calibration every few weeks and whenever the batteries are changed. ■ ■

PARTS LIST

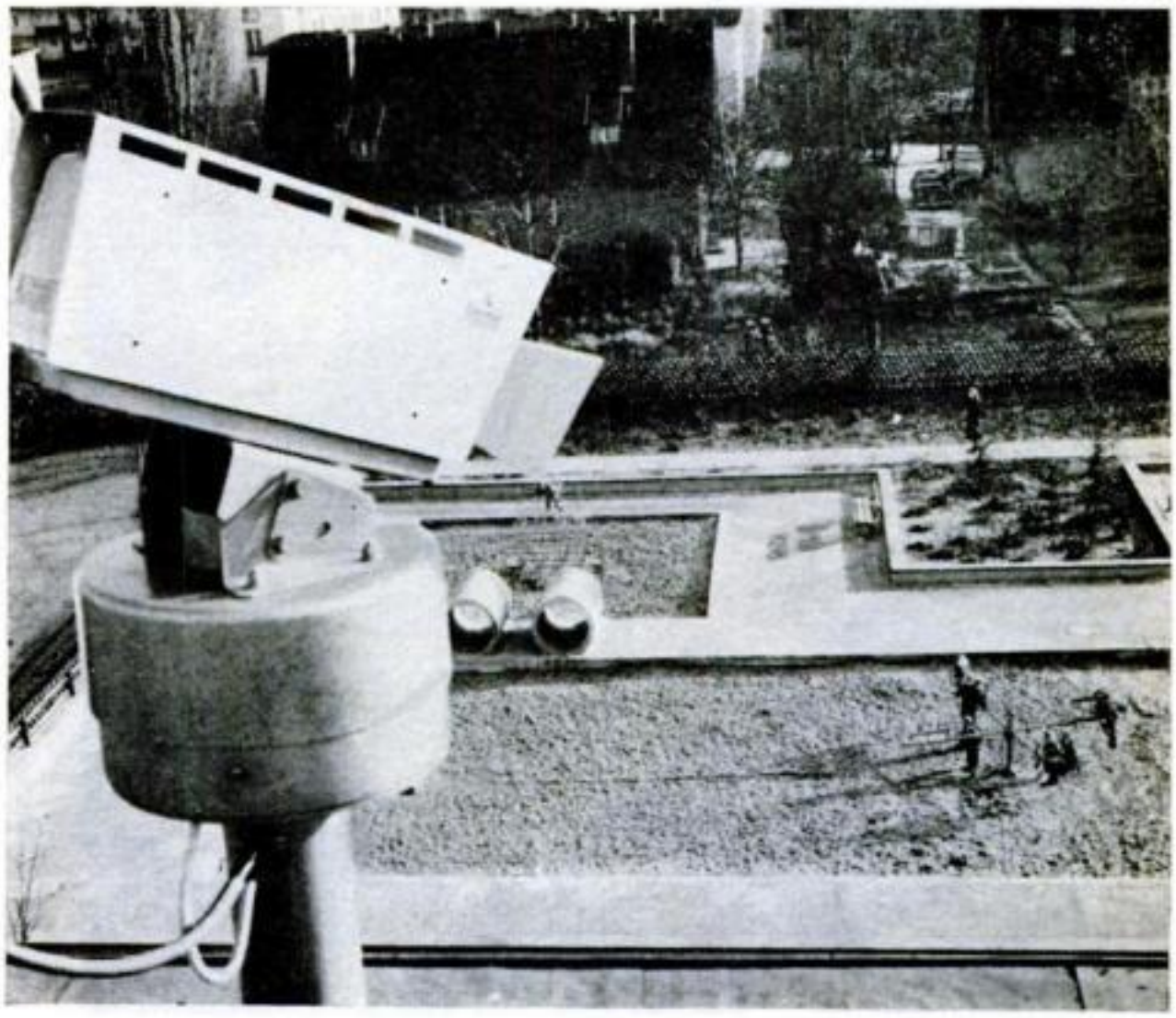
R1—120,000-ohm, ½-watt carbon resistor
R2—220-ohm, ½-watt carbon resistor
R3—2,700-ohm, ½-watt carbon resistor
R4—1,800-ohm, ½-watt carbon resistor
R5, R6—33,000-ohm, ½-watt carbon resistor
R7—2,200-ohm, ½-watt carbon resistor
R8—330-ohm, ½-watt carbon resistor
R9, R10—200-ohm hum adjust potentiometers
Q1—2N1304 NPN transistor
Q2, Q3, Q4—2N270 PNP transistor
D1, D2, D3—1N60 germanium diodes
C1—1-ufd., 15-volt electrolytic capacitor
C2—.05-ufd. disk capacitor
C3—.068-ufd., 200-volt tubular capacitor
C4—1-ufd., 200-volt tubular capacitor
C5—2-ufd., 200-volt tubular capacitor
M1—0-1 ma. DC milliammeter (Parker S-35 0-1 ma; available from Allied Radio, Chicago)
T1—filament transformer, 6.3-volts AC @ .6 amps (Stancor P-6465 or equal)
L1—6.3-volt pilot lamp in holder
S1—SPST toggle switch
S2—DPDT toggle switch
Probe—magnetic pickup coil (Allied 58 R 297 or equal)
Misc.—minibox, batteries, battery holders, Vectorboard perforated circuit board, push-in terminals, handle

Urheberrechtlich geschütztes Material

Midget bike has handlebars in rear

With the handlebars behind him and the grips held at hip level, this bicycle rider enjoys an "armchair" ride. Dismounting is simple—he just steps down over the bantam-size wheel up front.

The West German bike weighs 30 pounds, light enough to carry, and folds compactly to fit into the trunk of even a tiny foreign car.



Big-brother roof TV has eye on play yard

New apartment houses in West Berlin now provide tenants with a closed-circuit television channel that can be tuned in on their regular TV sets.

Mounted on the roof, the camera is trained on the building playground. A flick of the dial, and a mother, busy with her household duties, as at right, can be assured that her children are safe at their play.

Look-down window gives view near truck's front

A horizontal window over the grille lets the driver of a big Italian truck see what's immediately in front of him for easy parking and tight maneuvering. Its reverse-slant windshield also improves near vision.

Built by a tractor manufacturer, the Samecar Elefante is powered by a 455-cubic-inch air-cooled V-6 diesel. Rated at 18 tons, it has a speed of 40 m.p.h.

Urheberrechtlich geschütztes Material

New Ideas from the Inventors

Space vehicle lands as plane. Shot into space as a cone-shaped rocket nose, this recently patented capsule would be able to attain the high speed necessary to orbit after separation from its booster. On re-entry into the atmosphere, under pilot control, the side and tail sections would unfold for maneuvering earthward as a plane. It could then land on any level area.

Pump inflates low tire. If air pressure in this tire fell below a predetermined level, flexing of the walls would cause molded-in piston rods to move in and out, pumping air in through a valve. The pump would stop when the tire was inflated. Two or more lightweight pumps could be built in to give better balance to the tire.

Twin bowl tosses salad. You could toss a salad quickly and easily, and spread the dressing evenly without bruising any of the ingredients, in a mixer like this. Two bowls fitted to a crank and stand would lock together while you spun them, then separate so you could serve the salad in either or both of the flat-bottomed sections.

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Paint stand clamps to scaffold. This wheeled holder would travel along as you painted, clamp securely to the edge of a scaffold or ladder platform, and support a paint can at no-stoop working height. A pivoted handle under the holder would open against a spring that normally holds the scaffold-clamping jaws closed.

Wheels set one-hand slide rule. Circular slide-rule scales laid out on disk rims—and knobs extending to both sides—would let you do all rule-type calculations with either hand, keep the other free for noting the answers. This rotary rule could have two or more independent disks scaled in much the same manner as flat rules.

Pushcart cutter clears brush. A gas engine set low in this machine would propel it over rough terrain with little danger of tipping and would also power an outboard, belt-driven saw blade (adjustable for speed, height, and angle) for cutting small trees or brush. The engine could also be used as a power source for other tools.

The following patents have been issued on these inventions: **Space plane**—*No. 3,147,936 to E. J. Mercille, Creve Couer, Mo.;* **Tire pump**—*No. 3,150,705 to F. M. Geraghty, Hanwell, London, England;* **Salad tosser**—*No. 3,081,070 to C. Welsch, NYC;* **Paint-can holder**—*No. 3,051,429 to G. L. Long, Little Valley, N.Y.;* **Rotary slide rule**—*No. 3,129,881 to S. Wasserman, Daly City, Calif.;* **Pushcart brush saw**—*No. 3,080,896 to E. Brown, New Braunfels, Tex.*

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington, D.C. 20231, at 25 cents each. To write to an inventor, if the address above is insufficient, address him (by name and patent number) in care of the Commissioner of Patents.

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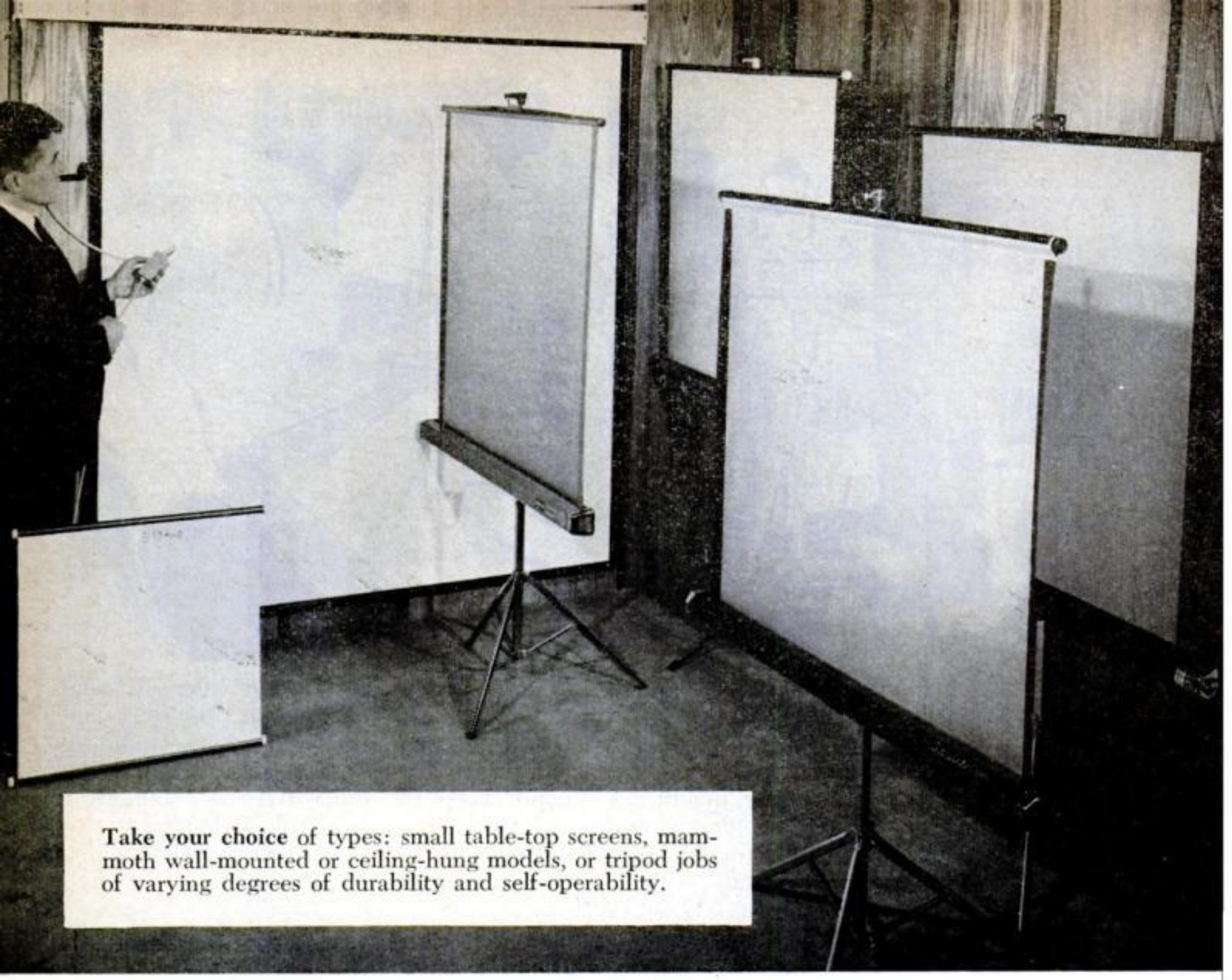

Take your choice of types: small table-top screens, mammoth wall-mounted or ceiling-hung models, or tripod jobs of varying degrees of durability and self-operability.

PS PHOTOGRAPHY

How to Buy a

Slides? Movies? Both? Here's how to pick out a screen that will do exactly what you want

By John Hansen

THE fun of photography, today more than ever, lies in bouncing your pictures off a screen. The projection screen has thus become almost as important as your camera and projector. That's why you have to know what to look for when you walk into a store to buy the right screen for your equipment, your pictures, your audience, and your projection area.

What size should you get? The screen size you need is determined by several factors. The table farther on gives sizes on a purely mechanical basis: projection distance vs. focal length vs. film size. With it, you can determine the screen size your equipment and space limitations will permit. There are other considerations.

- The size of your audience. If you often have a gang in to view your pictures, you need a screen big enough so that everyone can sit back and enjoy the show in comfort. If you normally show to a small group—three or four—you are just as well off with a smaller screen.

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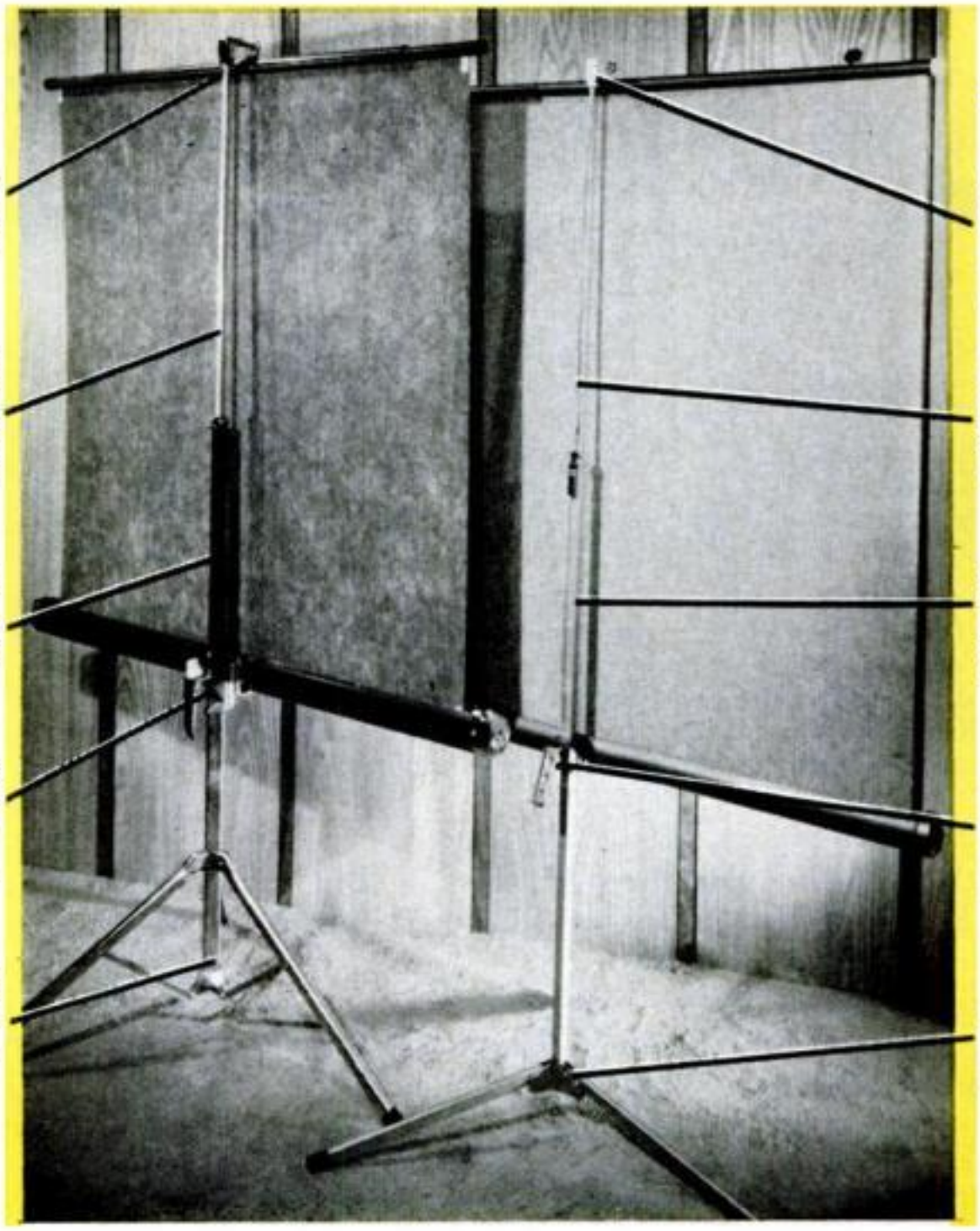
What your dollars buy in a projection screen


EXPENSIVE
Keystone-eliminator and rugged die-cast hook at top of standard.
Riser may be a square tube of heavy gauge to keep screen nonrotating.
Automatic features to erect tripod easily, keep tension on screen, etc.
Rugged lock-up: device combined with handle slides screen up or down.
Tripod base should be sturdy, have positive locking, automatic opening.
ECONOMY
Top may lack a keystone eliminator or leveler, but both can be improvised.
Riser that's light and round may let screen swing, making it hard to align.
Automatic opening and tensioning, if lacking, make setting up harder.
Lock mechanism on any screen must clamp tight, hold under repeated use.
Look for strength in tripod, if choice is between that and automatic features.

Projection Screen

• The quality of your pictures. If you shoot carefully on good equipment, you want to show your pictures big—dramatically. Viewed from the proper distance, a big projection of a sharp picture looks even sharper.

• The closeness of the screen to the audience. If you must set up so that the viewers are close to the picture, there is no point in a big screen; it would be impossible to take in from up close. Also, a big projection looks unsharp from close up.

• The texture of the screen you select. Texture is related to screen size only in that a coarse-textured screen, viewed from close distances, looks grainy, or reveals its texture. The smaller a screen, the finer its texture should be, since it will most likely be viewed from close up.

How close should the audience be? The Society of Motion Picture Engineers, a professional group that worries about motion-picture theaters, has a rule that is useful in home viewing. It is the "2 and 6" rule: "No viewer should be closer to the screen than two screen widths; no viewer should be farther from the screen than six screen widths."

Within these limits, perspective is acceptable, and the picture is sharp. The eye can take in the entire screen at once, without head-jerking. This formula fits the

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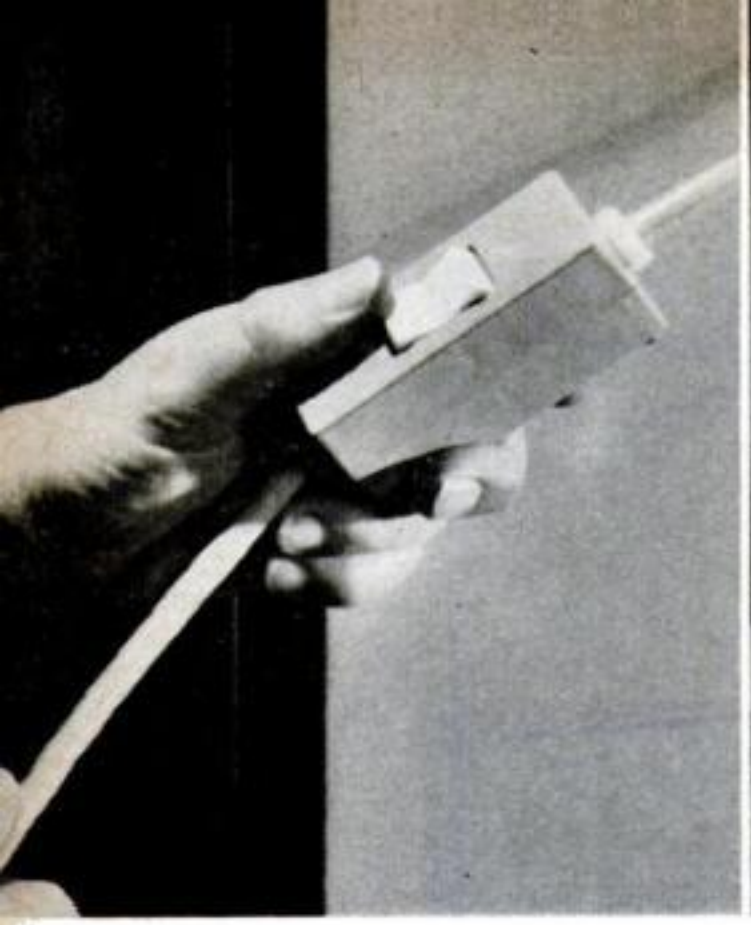


Most deluxe of projection screens is wall-mounted model. It rolls up and down at flick of a switch. Mount it permanently on wall or ceiling and paint it to match the background.

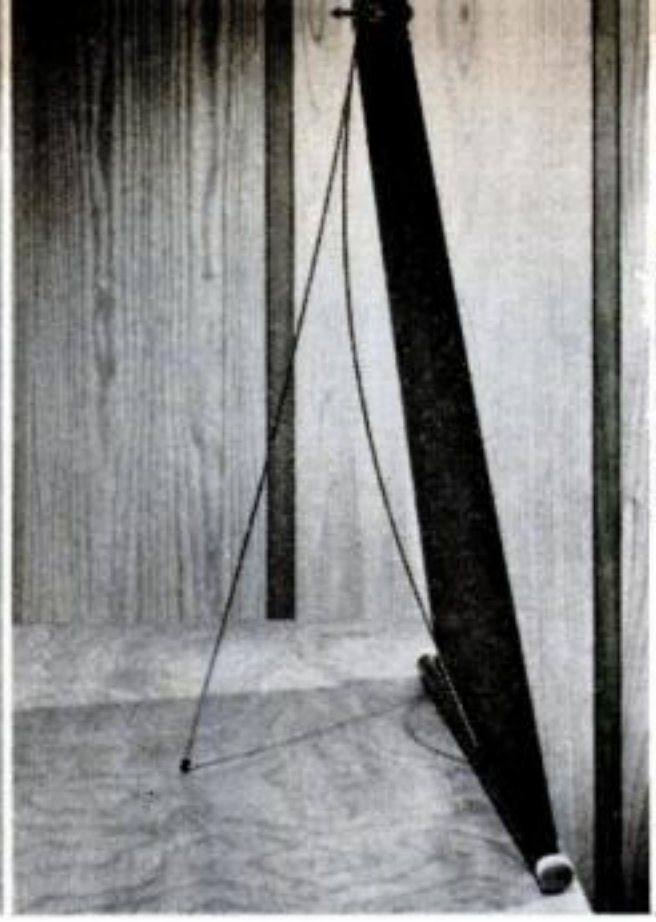


Table-top type, a simple little spring-tensioned job, is a useful second screen. Use it when only two or three are viewing, or when you project your moving pictures or slides for editing.

Carrying handle of projector usually combines with locking device and automatic raise-and-lower controls. Good design and construction are critical if the screen is to have a long life.

audience to the screen; you then fit the projector to the screen by means of focal length.

Screen manufacturers report that their biggest sellers today are 50″ by 50″. Their top size for home showing is 70″ by 70″. (This is for slide projection; for movies, the 70-inch dimension is width.)

Why shouldn't you always use the biggest screen? Image brilliance. When you enlarge too much, you lose image brilliance. The control here is the *f* number of your projector lens. A lens with a larger aperture will permit bigger projection than one of smaller aperture.

Also, the focal length of your lens. There is no sense in owning a screen bigger than you can fill with picture from your maximum projection distance with your focal length.

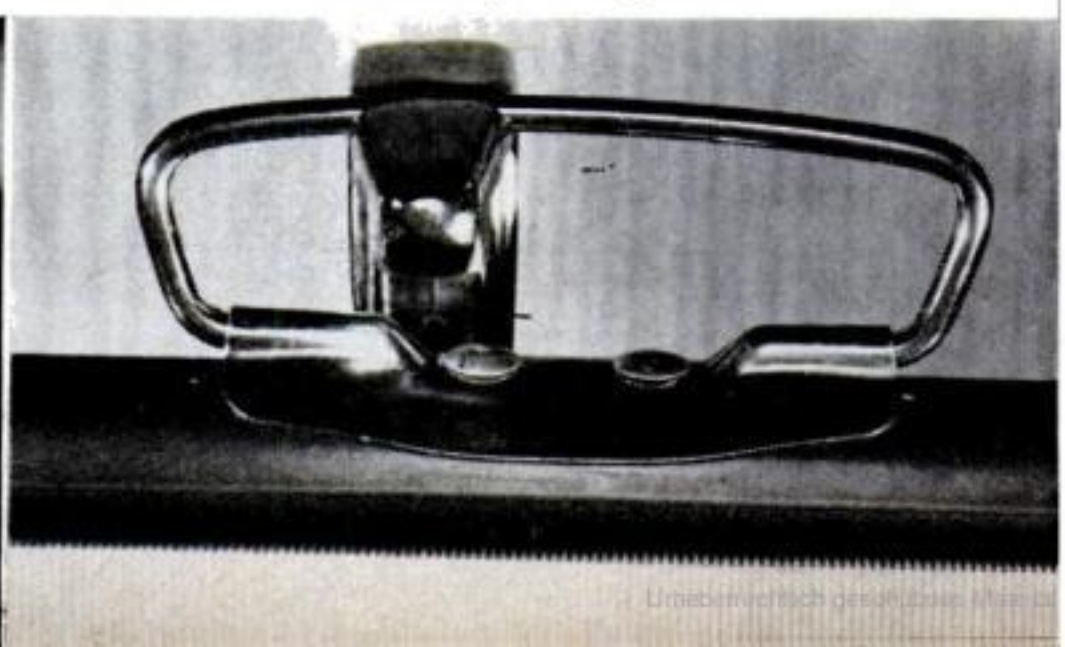
But it is a good idea to use the biggest screen possible with your equipment. The cost from one size to the next is not significant. You spend only about $5 more for a 50″-by-50″ than for a 40″-by-40″, regardless of screen surface.

Which screen surface is best? That depends on conditions.

Mat white. This is the purist's surface. The image is sharpest. Colors are most true. Angle of view is widest—although this is almost inconsequential, compared with the fine-grain beaded screen. But brightness is not as good as with other surfaces. If your projection system is good (high-quality, well-designed optics and illumination) and if you show in a well-darkened room so that the image is not diluted by incidental light, mat white is hard to beat.

Notched hook at top of riser helps eliminate keystoning by tilting top of screen out toward projector. Most manufacturers have an attachment you can use for further correction.

Screen leveler is simply a bale at the top of the screen. It can be positioned off-center to make screen horizontal even if standard is not vertical. This kind of device is easy to improvise.



Beaded. The newest and best glass-beaded screens are extremely fine-grain; the beads are almost invisible. Some lower-priced screens have larger beads, which can be seen if you get too close.

The advantage of the beaded screen is brilliance. Each tiny glass bead acts, in a way, as a lens and intensifies the reflected image. Sharpness is good. Brightness holds up, even at an angle of 45 degrees or so.

Well-darkened surroundings suit the beaded screen best, although it will stand a little more stray light than the mat white.

Lenticular. This means "lens-like." Lenticular screens have a surface of vinyl or other plastic, aluminized to make it silver in color. The plastic is molded into a ribbed or waffled pattern that reflects a very bright image. Thus the lenticular screen may be used in rooms that cannot be darkened—even in broad daylight, if the projector is strong.

The ribbed lenticular gives good viewing from the side, but the amount of light reflected upward or downward is small. The waffled lenticular reflects the image up, down, and sideways equally.

The fall-off in image brightness when viewed from the side is greatest with lenticulars. Usually, they are not recommended when it is necessary for much of the audience to sit very far to the side. From the front or near the front, however, the reflection from a lenticular screen is brightest of all.

Color fidelity is good although of course the white is always silver—not white—which the eye quickly adjusts for, but which may annoy the purist, since blues and reds are intensified.

Some lenticular patterns are bigger than others, and they may be visible from close

[*Continued on page 187*]

Three types of screen surface are shown below, about actual size. They are, left to right: beaded, lenticular, mat white. Photo shows texture. See text for discussion of relative brightness.

Tensioning device to keep wall-mounted screen flat is a necessity; it can't just hang. Cam-action type below is an example. Perfect flatness is most critical with lenticular screens.

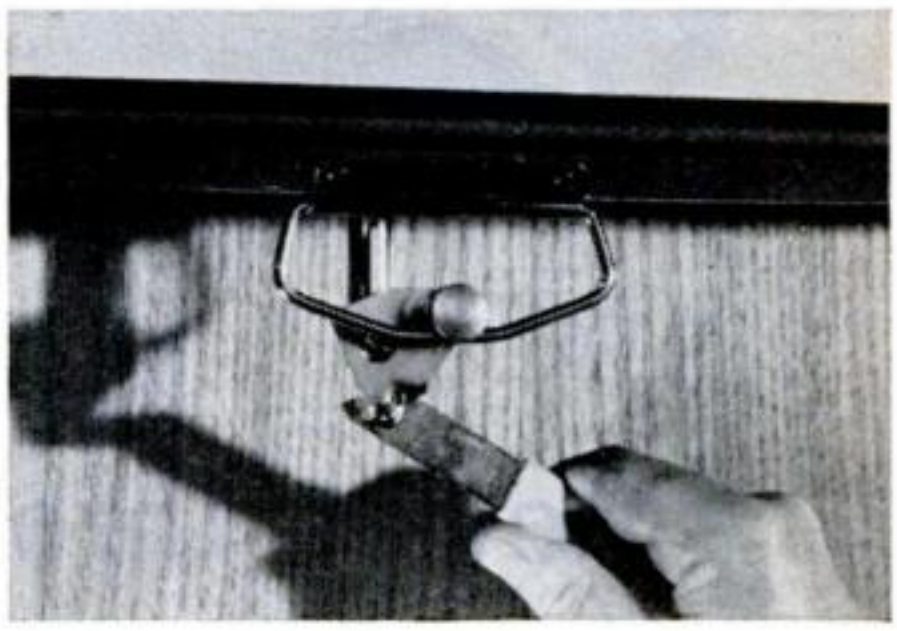


Table shows projection distances (in feet) necessary to fill common-size screens. For movies, sizes are *width* of screen; for slides, sizes are *square*. Use table to determine: a) room you need to fill screen, or b) what lens you need, or c) screen size you can fill with your lens.

PROJECTOR-TO-SCREEN DISTANCES	LENS LENGTH	SCREEN SIZE				
		30"	40"	50"	60"	70"
8mm Movies	¾"	11	14	18	22	25
	1"	15	19	24	29	34
	1½"	22	29	36	44	53
16mm Movies	1"	7	9	11	13	15
	1½"	10	13	17	20	23
	2"	13	18	22	26	31
	2½"	16	22	27	33	38
	3"	20	26	33	40	46
	3½"	23	31	38	46	54
35mm Slides (Distance is about 10 percent less for superslides)	3"	6	7	9	11	13
	4"	7	10	12	15	17
	5"	9	12	16	19	22
	6"	11	15	19	22	26
	7"	13	17	22	26	30
	8"	15	20	25	30	35
2¼x2¼ Slides	5"	6	8	10	12	14
	6"	7	9	12	14	16
	7"	8	11	14	16	19
	[illegible]	11	14	17	21	24

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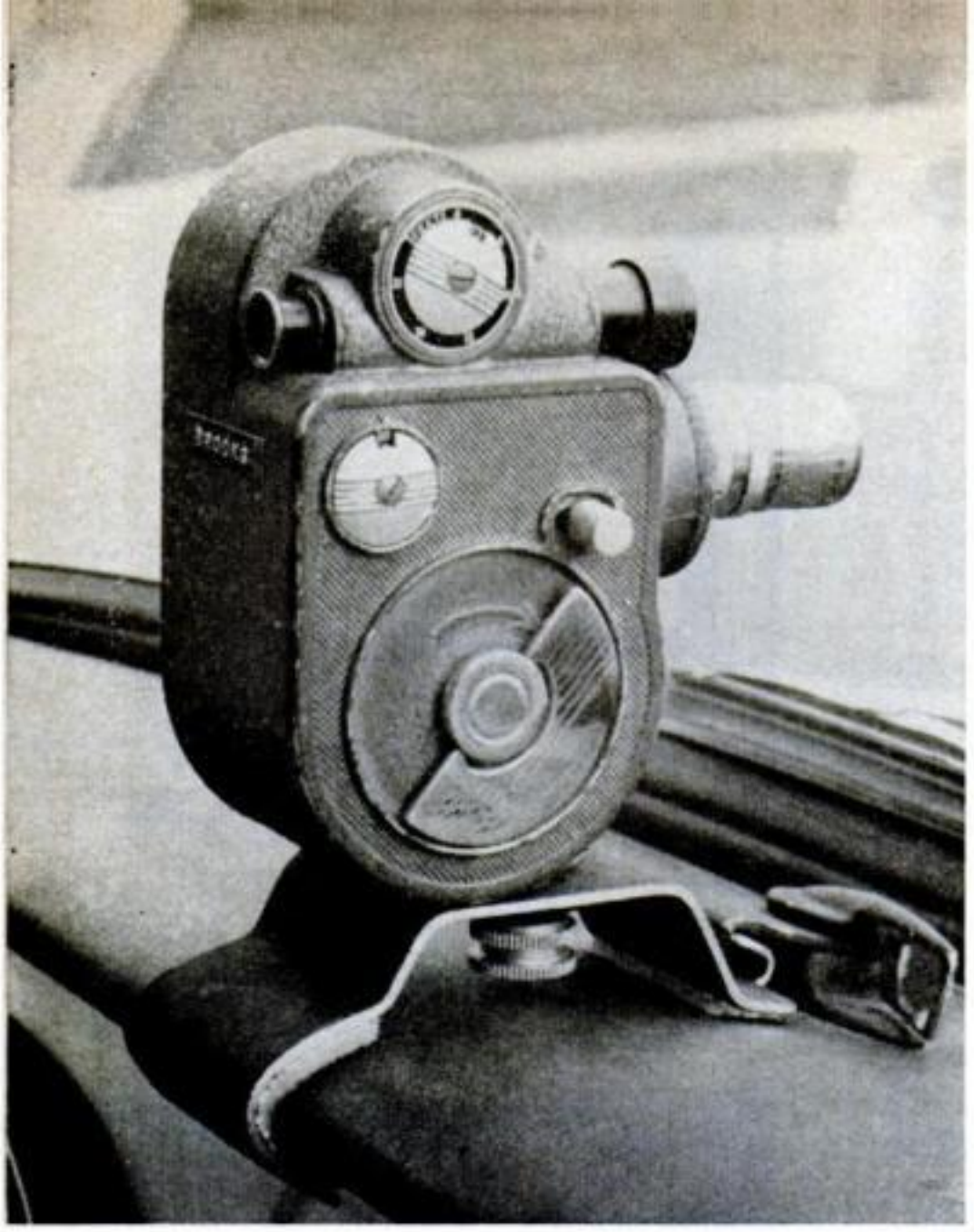


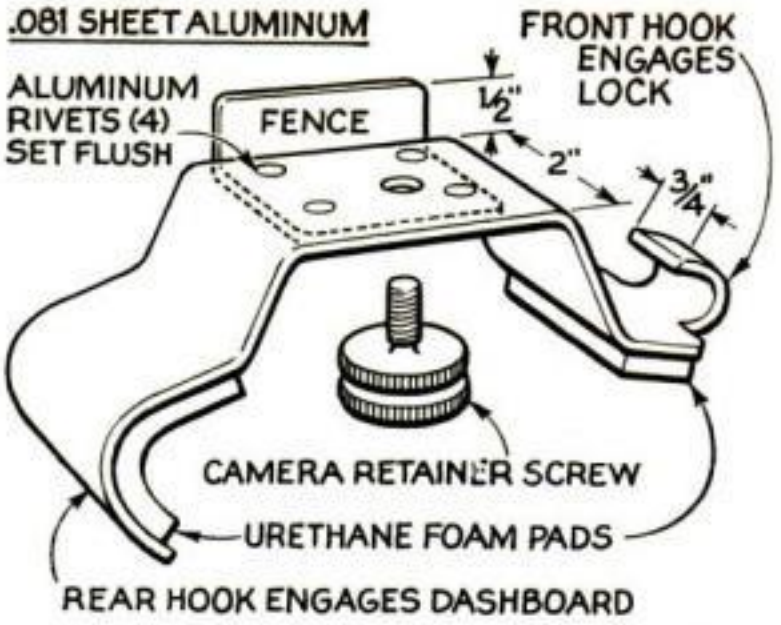
PS PHOTOGRAPHY

Making Movies Through Your Windshield

DRIVING there is half the fun—so why not include in your vacation movies driver's-eye views of entering tunnels, driving across bridges, and cruising through unusual countryside?

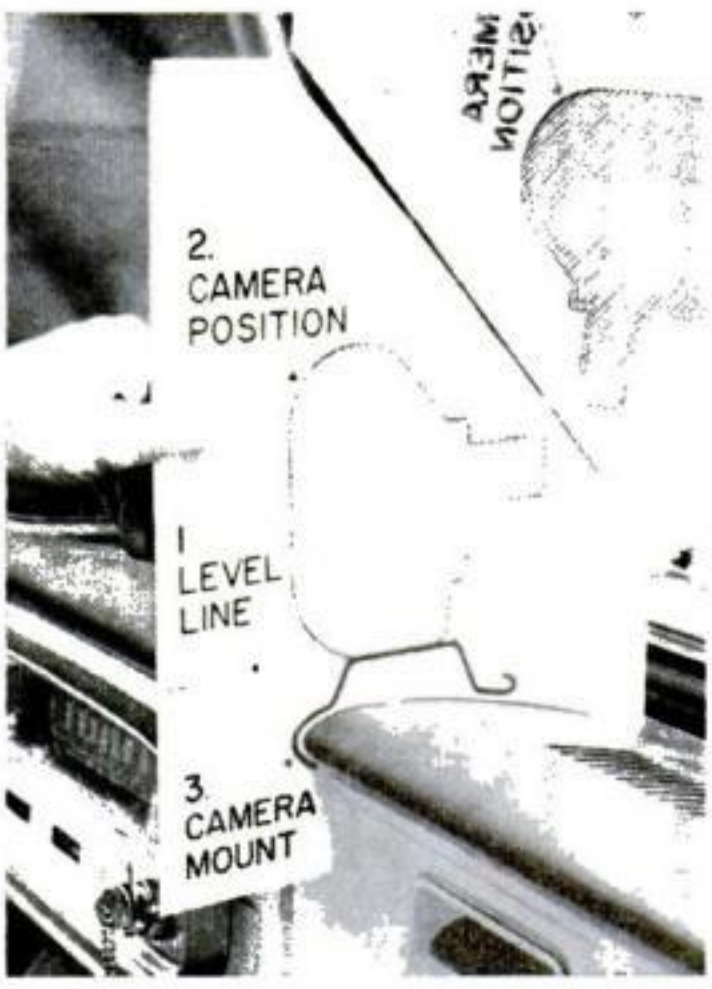
The only special equipment you'll need for perfect through-the-windshield movies is a dash-top camera mount. You can make one in an evening. The mount is an aluminum strip bent to fit your dash. Its rear hook grips the dash lip, and its front hook engages a cam-type sash lock that's bolted to the dash. You can install or remove the mount in seconds.

For a template, fit a piece of cardboard as shown in the bottom right photograph. Park on level ground, and draw a level line across the cardboard, about ¾" above the dash. Position your camera on this line with its lens about ¼" from the windshield, and outline the camera. Now you can detail the mount's profile. Shape a 2"-wide aluminum strip to the profile, tapering it to ¾" at the front to form the front hook. Drill a hole aligned with the camera's tripod-mounting socket to take a retaining screw.—*Ken Brooks.*



Rivet an angle fence to mount—this keeps camera pointing straight ahead. Sand rough edges of mount and cement ¼"-thick foam pads on the mount bearing points to protect dash.

Cam-action sash locks are available at most hardware shops. Position the lock on the dash so it draws the mount up snugly; fasten it in place with flathead bolts.



Fit a cardboard template to the dash and windshield. For best through-the-windshield shots, the camera lens should be held parallel to the ground and about ¼" from the windshield.

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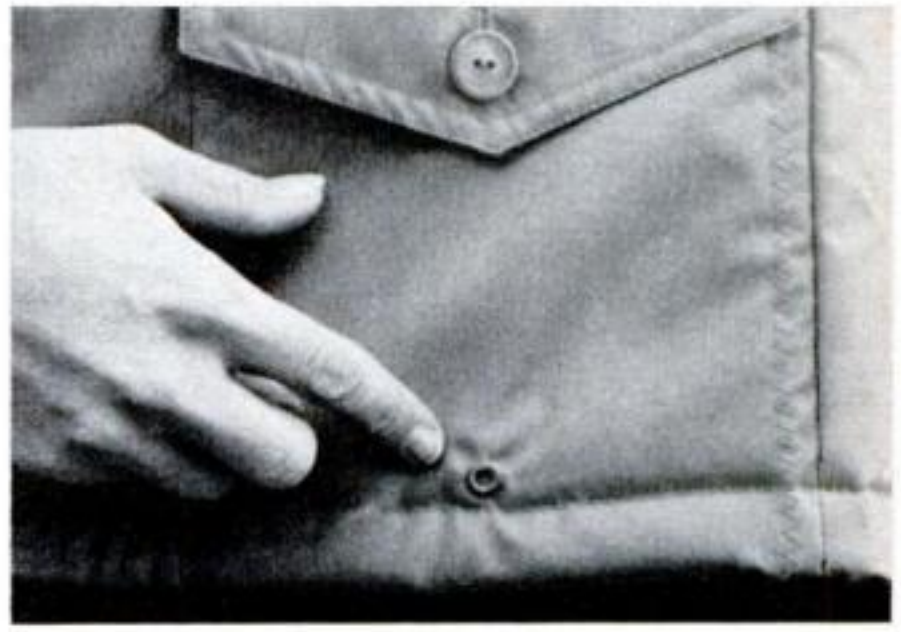
Coat is modishly tailored for wearing on deck.

It floats if wearer should fall overboard.



Grommet at bottom drains pocket after dunking.

Boating wear—stylish and safe

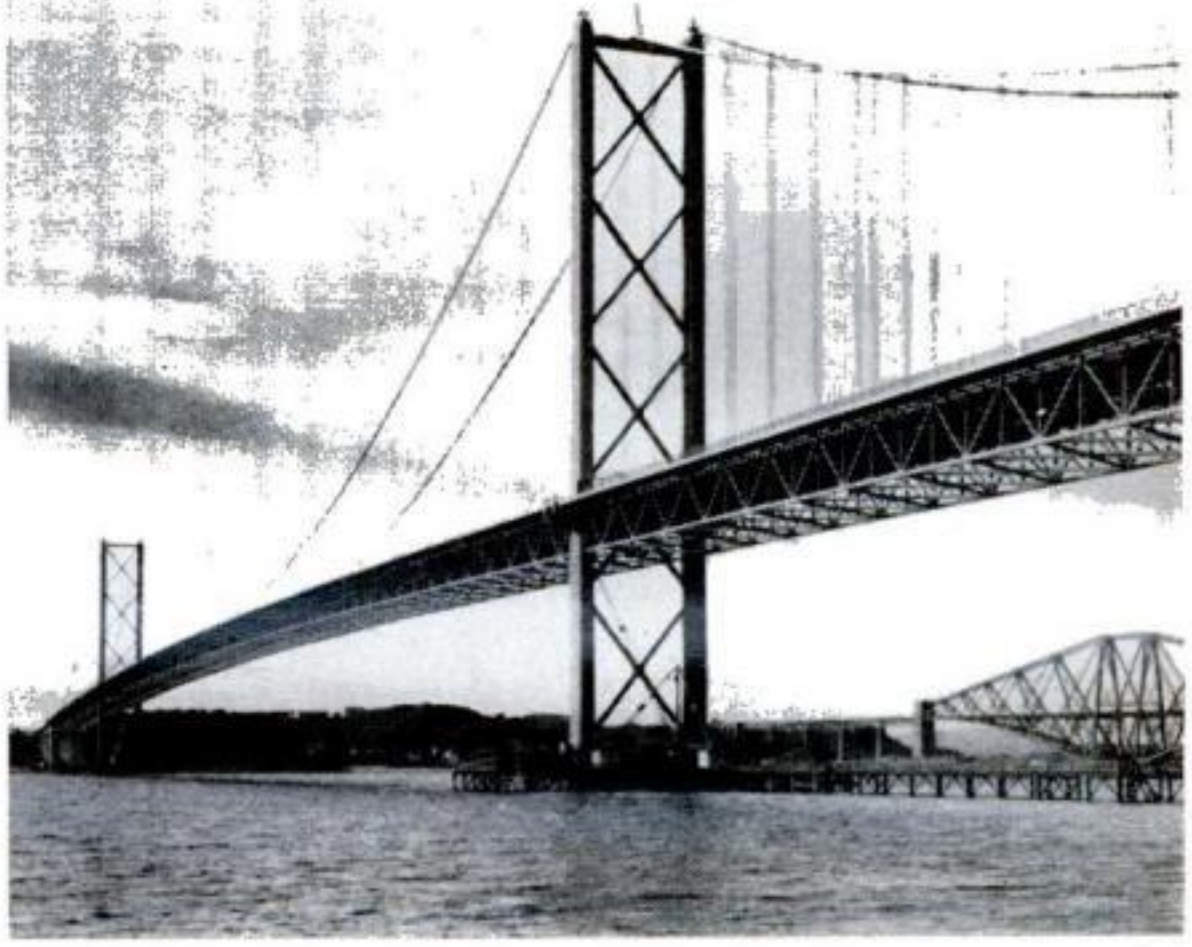
The women in your family won't balk at donning life vests when boating if their jackets look like this coat. Trim and fashionable, the Float Coat weighs only a pound, has a lining that insulates it for warmth and provides buoyancy that will keep even a non-swimmer afloat if she should go overboard. Made by White Stag, Portland, Ore., it was displayed at a recent California Fashion Creators' style show.

Bridge over Firth of Forth is Europe's longest

Motoring on the east coast of Scotland, you no longer cross the Firth of Forth by ferry. There's now a bridge —opened last fall by Queen Elizabeth. Its main suspension span is 3,300 feet, longest in Europe.

New York's Verrazano beats it with 4,260 feet, San Francisco's Golden Gate with 4,200, Mackinac 3,800, and George Washington 3,500.

In the background is the famous cantilevered railroad bridge completed in 1890. It contains 58,000 tons of steel, the new one 30,000.



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Can you answer these questions about

BLOOD?

New questions—and new answers—are coming fast as science studies that mysterious sea in your body

By Lawrence Galton

YOU have 12 to 13 pints of a magic red fluid circulating in your body. Just how magic becomes more apparent with each new discovery about blood.

Along with exciting discoveries there are headaches, too: shortages of blood; serious, even deadly, reactions from bad transfusions.

You may be surprised to know how great the chances are that you or someone in your family will need a blood transfusion at some point—one in 80 chances for you yourself in just the next 12 months. And the odds are increasing, too, that some component of blood or some new bit of knowledge about blood may save your life or, short of that, a lot of misery.

What's blood made of?

An extremely complex substance, about 55 percent of blood is an amber fluid, plasma. Suspended in the plasma are huge amounts of three major components: red cells, white cells, platelets. In just a single average cubic millimeter of blood (1/30,000 of a fluid ounce) are 5,000,000 red cells, 8,000 white, and 300,000 platelets.

What does blood do?

One job, as it's pumped by the heart through some 60,000 miles of vessels, is to carry oxygen from the lungs to all body tissues. A chemical in red cells, hemoglobin, does the oxygen-carrying—and also latches onto carbon dioxide given off in the body tissues and moves it back to the lungs so you can get rid of it by exhaling.

Blood also transports food substances from gut to body tissues; acts as a cooling agent by distributing the heat from working muscles; and serves as an instrument of the brain. For instance, at the base of the brain, the pituitary gland produces hormones that con-

- ***How risky is a blood transfusion?***
- ***How can blood tests settle a paternity suit?***
- ***Is blood damaged when it's frozen?***
- ***Can you get a transfusion of your own blood?***
- ***Can you have too much blood?***
- ***How do doctors use blood to diagnose diseases?***
- ***Can doctors use blood from dead people?***

trol the workings of other glands. When the brain wants to get something done, the pituitary releases the right hormone into the blood, which transports it to the particular gland—adrenal, thyroid, etc.—to be stimulated.

How does it fight disease?

White cells, part of the body's defense system, surround and engulf invading bacteria. Plasma, too, contains defenders. Called antibodies, they're chemicals—a variety of them—so shaped that they can fit and lock onto specific invading organisms such as those responsible for measles, mumps, polio, and other diseases.

The platelets also do an important defense job, forming clots that plug breaks in blood vessels to stop bleeding.

Is your blood unique?

It's almost as distinctive as your fingerprints. That's because red cells contain antigens, chemicals that act as blood-group factors. Each person has his own complex arrangement of them.

Technologist conducts experiment to separate proteins in blood plasma and determine what they do.

All human blood can be divided into four major groups—O, A, B, and AB. Each of these subdivides into Rh positive and Rh negative. And there are still other subgroupings—MN, P, Lewis, Lutheran, Duffy, Kell, Kidd, and

CONTINUED

Diego—with new ones being added to the list all the time.

Generally, of every 100 people, 45 will have group O blood and in 39 it will be Rh positive, in 6 Rh negative; 40 will have group A (35 Rh positive, 5 Rh negative); 10 will have group B (8 positive, 2 negative); 5 will have group AB (4 positive, 1 negative).

Thus, AB positive and negative, O negative, and A and B negative are considered comparatively rare since only about 17 percent of the population have such bloods. In addition, some bloods involve minor blood-group systems so rare that only a few individuals in the country share them. Only 20 people, for example, have been found with a blood type called TJA-negative.

Are blood types inherited?

They are—a fact, incidentally, that can be used to save men falsely accused in paternity cases. One top authority, Dr. Leon N. Sussman of New York, urges blood tests in all disputed paternity cases and claims that, for want of them, thousands of men, by court order, are supporting children not their own.

In one series of 1,000 disputed cases in New York City, blood tests showed that 40 percent of men denying responsibility were right; they couldn't have been the fathers of the children concerned. In another series, 18 percent of men who admitted paternity—thought they might have been responsible—were shown to have been in error.

Here's an example of how blood testing works, using one system, MN.

Every person is of type M, N, or MN. If both parents are M, all children must be M; if both are N, all offspring must be N. If one parent is M and the other N, all offspring must be MN. If one is M and the other MN, 50 percent of the children will be M, the other 50 MN. If one parent is N and the other MN, 50 percent will be N, the other 50 MN. If both parents are MN, 50 percent of the offspring will be MN, 25 percent M, and 25 percent N.

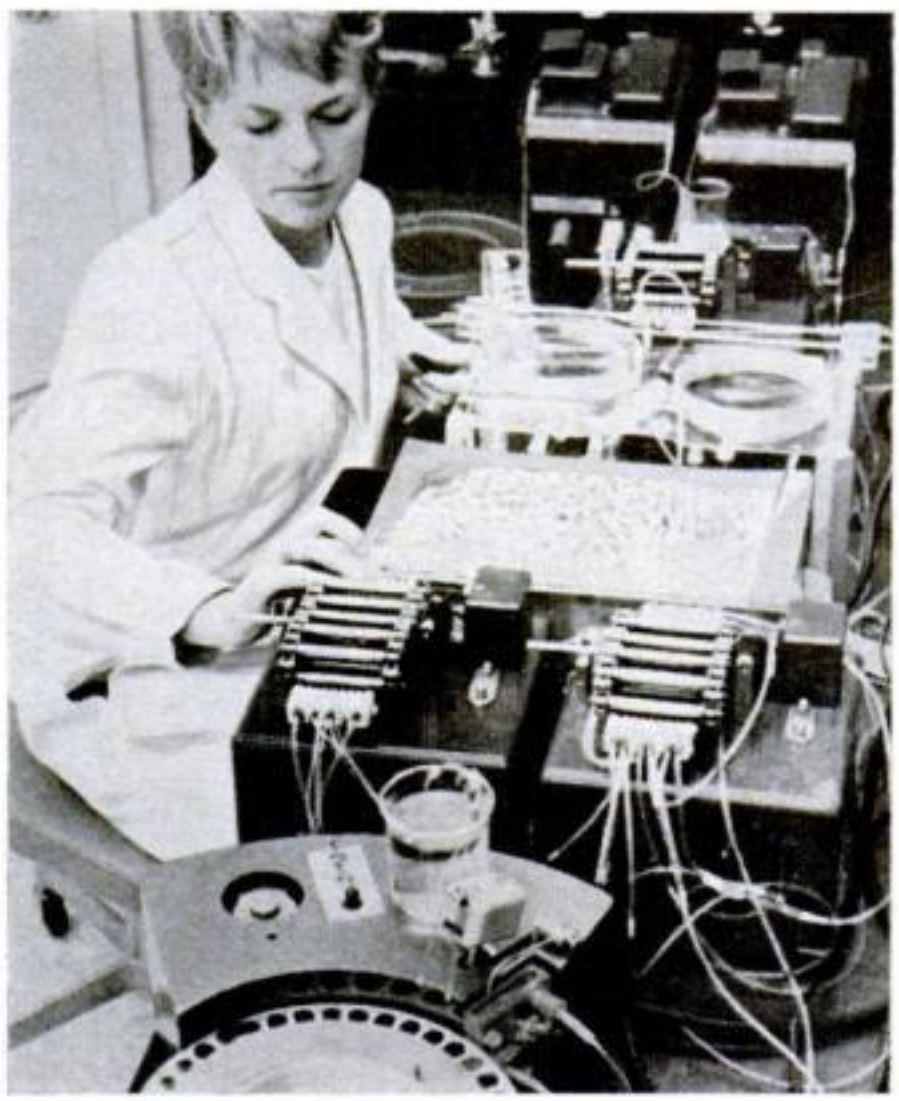
Thus, if an N mother has an MN child, the father would have to be M or MN. An accused man in group N would be excluded.

Do blood types affect transfusions?

Before 1900, when the first blood groups were discovered, transfusions were extremely chancy affairs—so often deadly that many doctors would have nothing to do with them. Some countries outlawed them.

When incompatible blood is transfused—say, an A negative receives another type—antibodies in the plasma will destroy the red cells in the donated blood and there may be so much clumping and bunching of those dead cells that they act like a big wad to impede or even stop circulation, with fatal consequences.

For a successful transfusion, bloods don't have to be identical, but they



Autoanalyzer at New York Blood Center types blood automatically. As red cells drop to bottom of sample, the machine measures color change and records the results.

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for a bleeding-ulcer case

should match both as to major grouping and Rh factor.

When are transfusions needed?

Whenever something goes wrong with the blood system, restoring an adequate volume with a transfusion can mean the difference between life and death.

A bleeding ulcer often calls for transfusions; as many as 40 pints may be needed in an individual case. Many women hemorrhaging after childbirth are saved by transfusions.

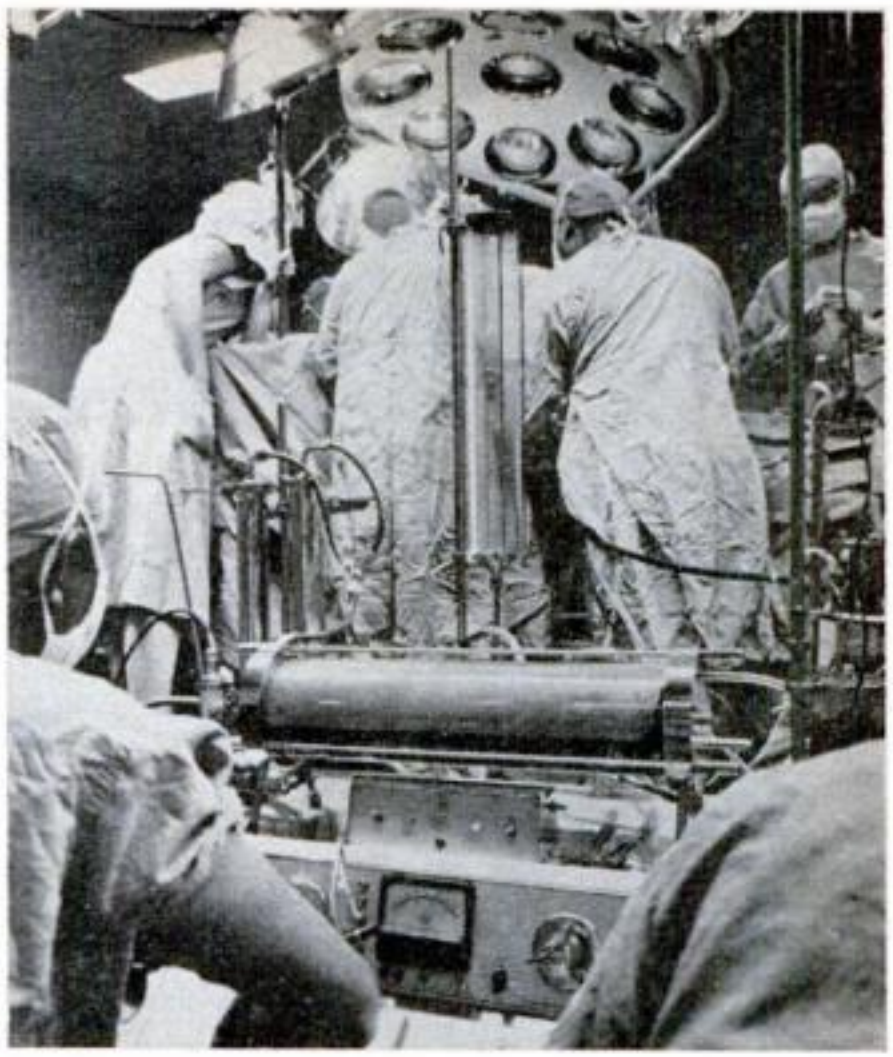
And many babies born with a disease involving incompatibility of blood between them and their mothers—erythroblastosis fetalis—have been saved by having their blood completely replaced within hours after birth. Actually, some babies die before birth because of the same disease. The newest development is to give a transfusion while the infant is still in the womb. (It's done by inserting a needle through the mother's abdomen into the womb, injecting into the fluid there a dye that the baby swallows and that shows up his abdomen under X-ray, and then inserting the needle into the child's abdomen and transfusing blood.)

Why are transfusions risky?

Accidental mismatching is one factor. Biggest problem, though, is transmission of disease by blood contaminated with malaria and especially with the virus of infectious hepatitis. Hepatitis has been transmitted by approximately one in every 150 to 200 transfusions.

A new autoanalyzer system for automatic blood typing is now coming into use. It eliminates human error. The device does the job with unfailing accuracy. As bunched-up red cells drop to the bottom of a sample, the remaining fluid becomes lighter in color. The autoanalyzer measures the color precisely and automatically records the results.

To meet a blood-shortage problem, new central blood agencies not only



Whole blood—10 to 15 pints—is needed to prime a heart-lung oxygenator (shown in foreground) which substitutes for patient's own organs during open-heart surgery.

coordinate blood collection and make it easier for people to donate—they also make its distribution more efficient. High-speed computers keep track of various types of blood at all hospitals and blood banks so when one hospital runs short of one type of blood it can be quickly supplied with it. The computers also keep track of donors of rare bloods so they can be located almost instantly when they're needed in an emergency.

What about freezing blood?

For years, there have been attempts to freeze blood so it could be stored for more than 21 days—for months, possibly even years. But freezing damaged the blood.

Now a new process doesn't. Developed under sponsorship of the Navy, which has long wanted a way to store blood indefinitely on ships in remote stations, it uses liquid nitrogen to get blood down to minus 320 degrees F. in just one minute and to keep it stored at that temperature. When the blood is needed, it can be thawed in a minute and

[*Continued on page 200*]

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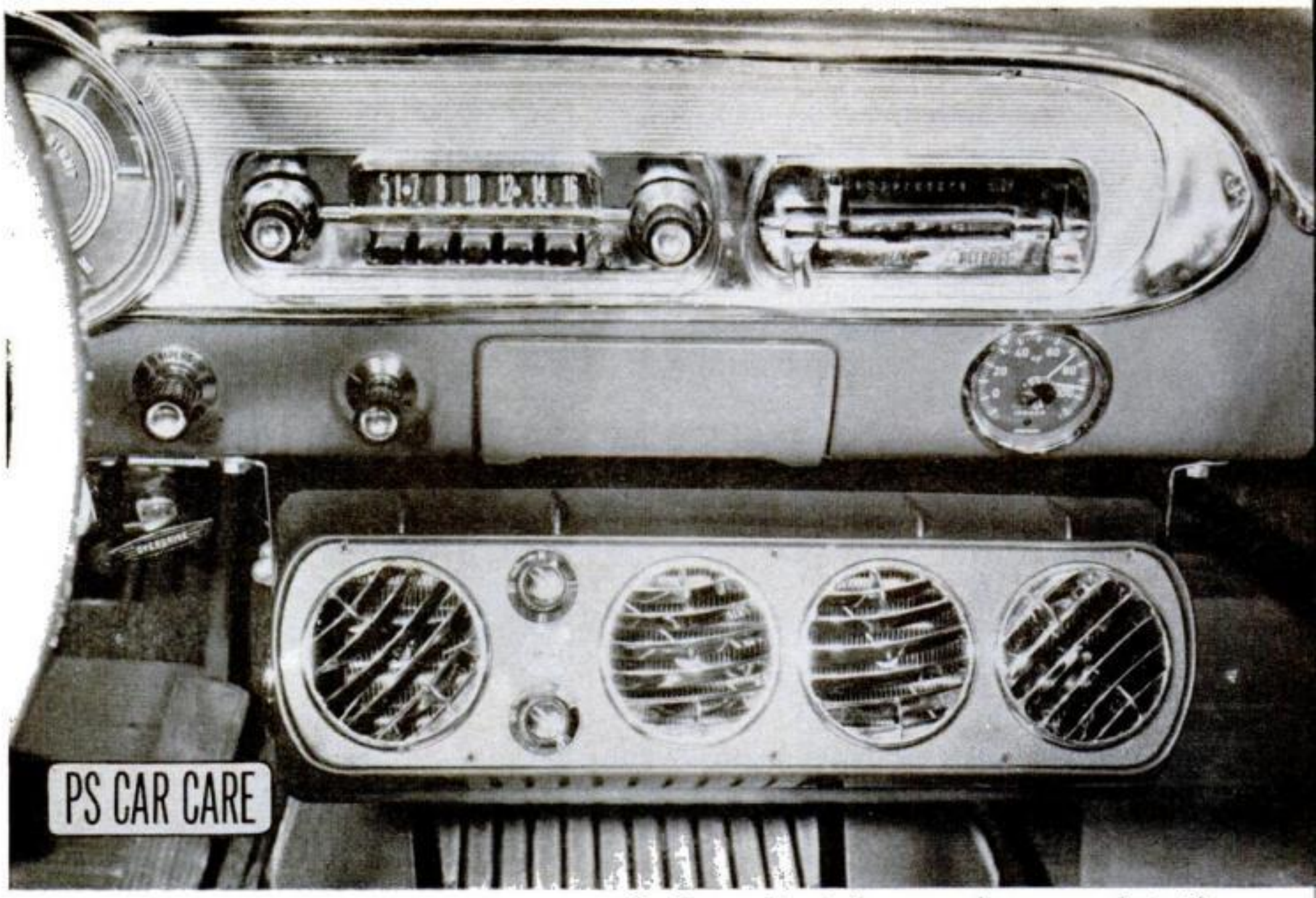

Cooling unit steals some leg room, but it's worth it. Dash thermometer shows outside temperature a hot 94 degrees; inside, it's a cool 72.

Personal-use report: A Car Air Conditioner

You'll drive cool, save over $150 in cold cash. Installation time? Less than eight hours

By Phil McCafferty

I FEEL pretty smug when I brag that my car is air conditioned, especially when I tell my friends that the unit cost me only $149. That's less than half the cost of a typical shop-installed accessory conditioner.

Why the bargain-basement price? Two reasons: First, I bought my air conditioner in kit form direct from the manufacturer—Comfy-Kit, 1707 East Ohio St., Dallas, Tex. And second, I installed the unit in my car myself.

I'll admit I was a bit skeptical when I opened the box and saw the tangle of hoses, cooling unit, compressor, condenser, and hardware. But the installation turned out to be a straightforward mechanical job, within the capability of any Saturday-afternoon wrench twirler. The result is an air conditioner equal in performance to any accessory unit sold—it even carries the same guarantee as most shop-installed coolers. While the manufacturer can't guarantee a perfect installation, it's hard to go wrong if you follow the instructions.

Installation. The manufacturer says installation is a four-hour job; it's possible, if your car has plenty of under-hood working room, especially in front of the radiator. Based on my experience—I have a V-8 Fairlane, and engine-room quarters are very close—I'd say figure on six to eight hours.

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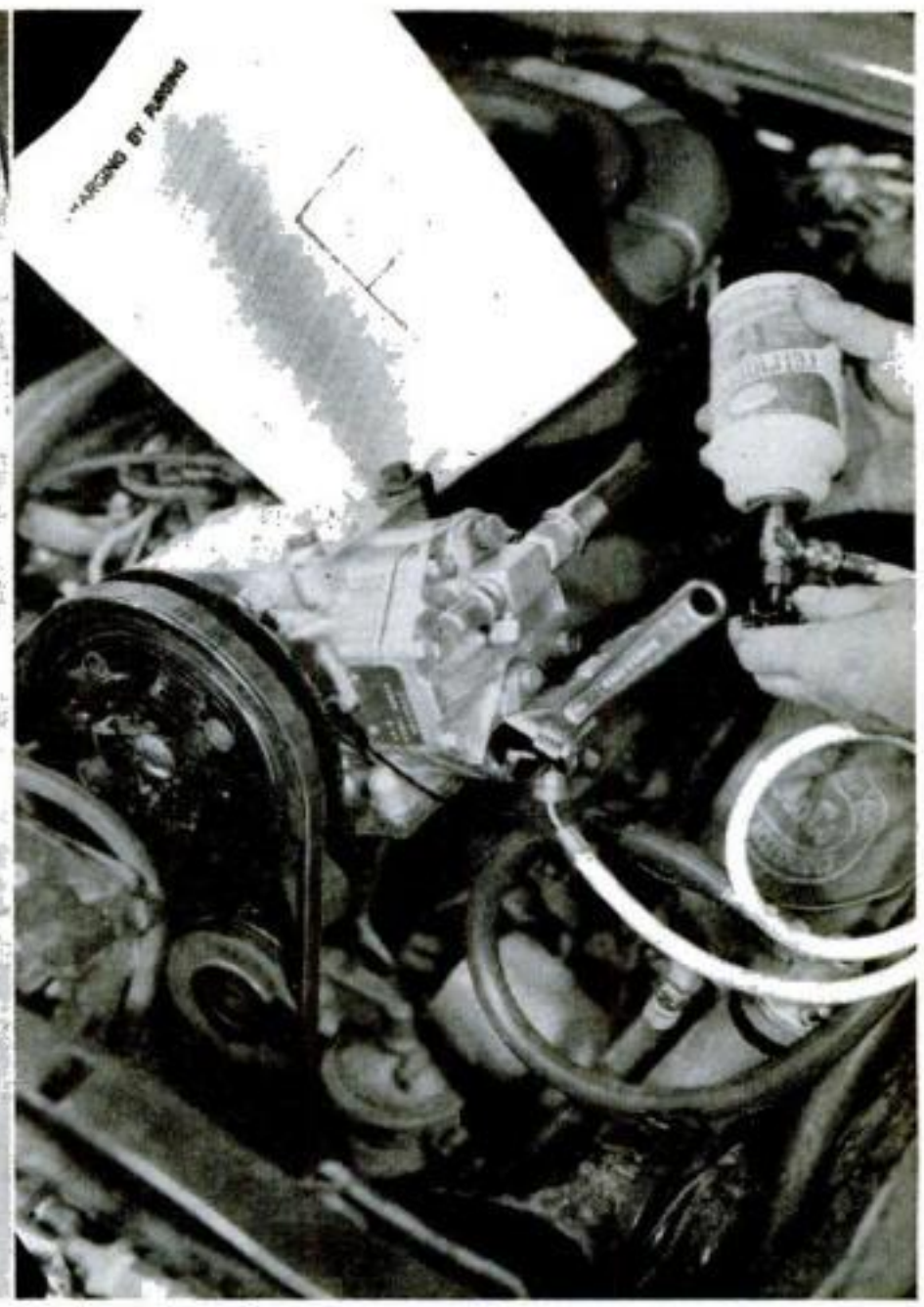
What you get: Here's what the postman brings for your $149. Condenser mounts in front of radiator, and compressor on front of engine.



Charging the system with Freon 12 refrigerant is the last step. It's done by metering into the unit, and purging off trapped air and moisture.

You Install Yourself

Installation is a reasonable do-it-yourself job because the manufacturer has done all of the tricky work. There's nothing to build; you simply mount the components in your car and bolt the works together.

The electrical wiring is complete; there are only two wires to hook up—one to the compressor's magnetic clutch, the other to your car's ignition switch.

The special receiver-dryer unit on the condenser allows you to charge the system with Freon 12 refrigerant (three pressure cans of Freon come with the kit) without first evacuating it, so you don't need a vacuum pump.

Instructions are complete, and generally easy to follow. There's a wealth of explanation of how the unit works, and an excellent trouble-shooting section that should be invaluable for servicing or repairs.

You'll need these special tools: a Freon-can tap, charging hose, and ¼" valve wrench to charge the system; a hole saw to cut access holes for the unit's hoses. If your car is a late model, it probably has factory-cut knockouts designed for air-conditioner hoses.

You can borrow these tools from the manufacturer without charge (there's an $8 deposit) or buy them locally. Or you can have a local air-conditioner shop charge the unit for you (they'll also check for leaks). The tab: $5-$10.

How good is it? The unit has a Spartan-looking under-dash grille, but, inside, it is mechanically identical to many high-quality accessory conditioners. Two "high-priced" features I liked:

- An adjustable thermostat controls the compressor. The magnetic clutch engages

CONTINUED

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Condenser goes in front of the radiator—the kit includes mounting brackets. Hint: Give yourself more working space by removing the grille when you install it. You run less risk of damaging the delicate condenser fins.

and activates the compressor whenever the thermostat signals for cooling.

● The unit uses dual squirrel-cage blowers equipped with an infinitely adjustable rheostat speed control. Low-cost conditioners often have less-efficient bladed fans controlled by a three-speed switch.

How does it work? In a word, splendidly. The manufacturer says the unit is designed to cool at least 20 degrees below outside air, although they can't guarantee a minimum temperature reduction because of the many variables involved. I found that the Comfy-Kit would usually chill my car 30 to 35 degrees below outside temperature. Running full blast, it could make me a lot colder than I considered comfortable.

To give the cooler a real test, I drove 6,000 miles during a 17-day period when temperatures averaged 92 degrees. Humidity ranged from a desert-dry five percent to a sopping-wet 100 percent. My route included congested city streets, mountain roads, superhighways, and no-speed-limit desert and plains stretches. Altitudes ranged from sea level to 9,000 feet.

On several days, the air conditioner ran continuously from early morning to well after dark. It worked perfectly at all times, and never failed to supply adequate cooling for comfort.

The manufacturer suggests you install a heavy-duty engine fan for better air circulation. This has six blades instead of the usual four, and is standard equipment on factory air-conditioned cars. You can have one installed for $5-$10.

I didn't bother with a heavy-duty fan, and I doubt that you'll need one unless you do a lot of stop-and-go city driving. During the test, my engine threatened to overheat only once: In a steep mountain climb to 6,500 feet, with an outside temperature of 106 degrees, the engine temperature gauge nudged toward the red line. But I reached the top before it was necessary to shut off the air conditioner.

Gas mileage, with the unit running continuously, fell off only a smidgen—about ½ mile a gallon. This is too small to worry about.

Tips for a better job. Here are a few things I learned when I installed the Comfy-Kit:

● When you order the unit, be sure to specify your car make, model, and engine. That way, you'll get compressor mounting brackets custom-tailored to fit your car.

● Tape or fasten all hoses well away from the engine (they can be damaged by heat) and the engine fan (a nicked hose means recharging the system).

● Be careful when you install the condenser—its delicate fins are easy to damage. You'll probably find it easier and quicker to remove your car grille when you mount the condenser—you'll have a lot more working room.

● Definitely install a bug screen in front of the condenser—impaired air flow will cut down the air conditioner's efficiency.

● The instructions refer to the hoses by size, but the hoses don't have their size stamped on them, and the kit doesn't come with a hose gauge. Fortunately, the fittings are all of different sizes, so you can find the right hose by trial and error.

● The instruction manual is a bit vague about the unit's charging valves. They are all back-seated and must be screwed all the way out to fully seat them before cracking one slightly to introduce Freon.

● Double-check all hose connections and valves to be sure they are leakproof.

The unit is a good buy, even if you have it charged by a local shop. Auto dealers say that an air conditioner adds $150 to the value of a used car, so how can you lose? And, after the first hot day's drive next summer, you'll wonder how you ever survived without air conditioning. ■■

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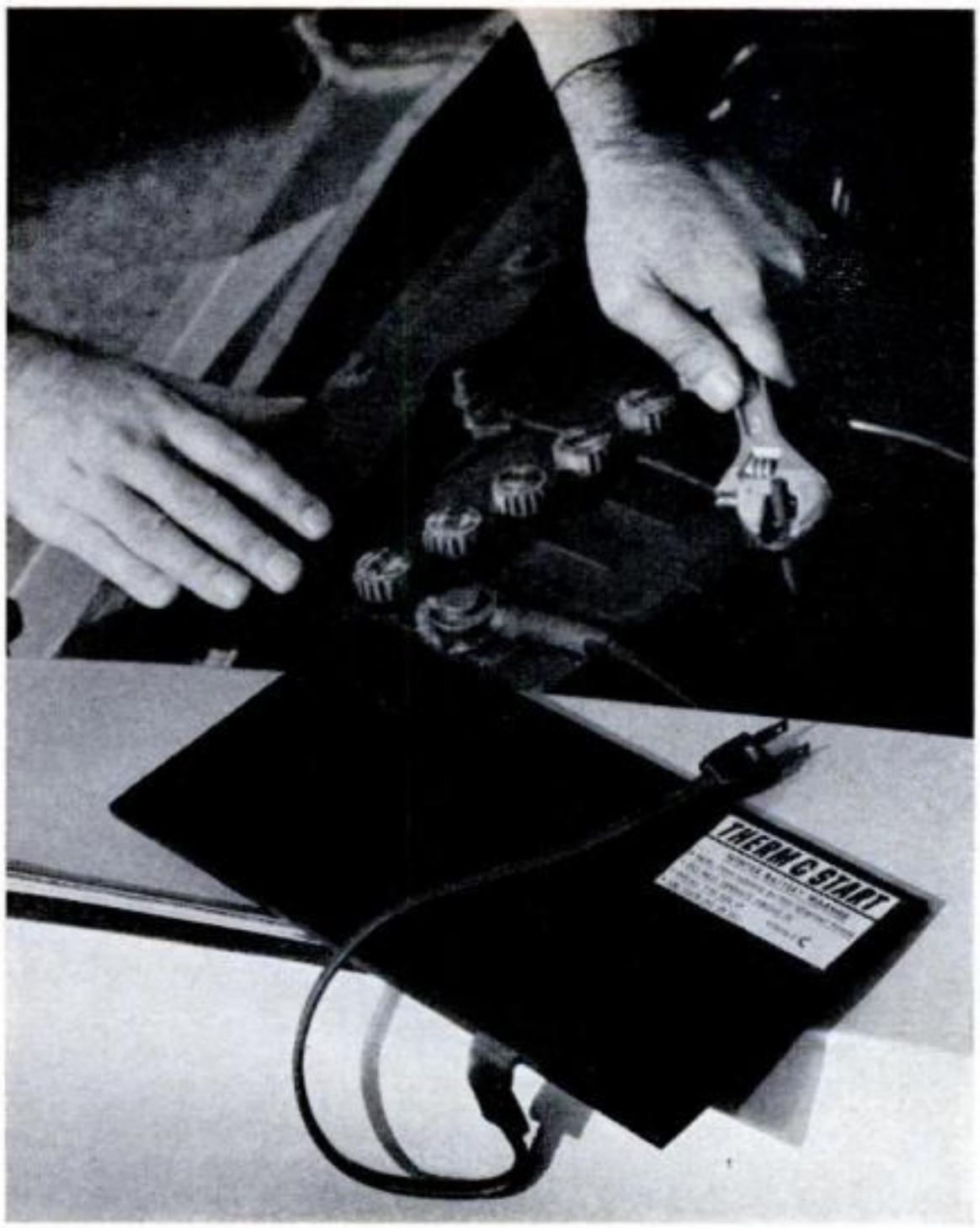
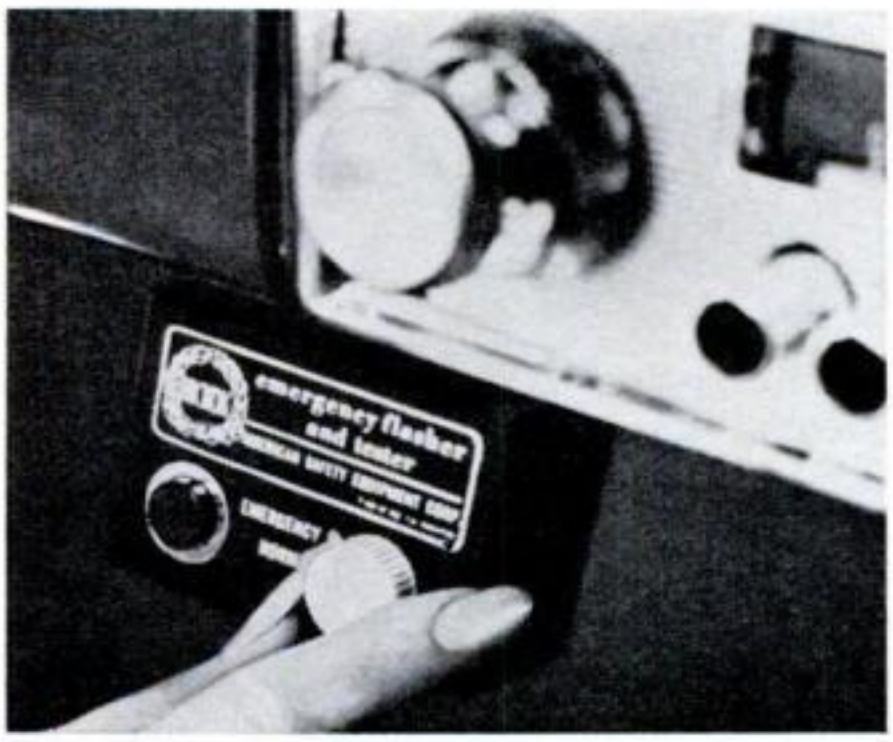


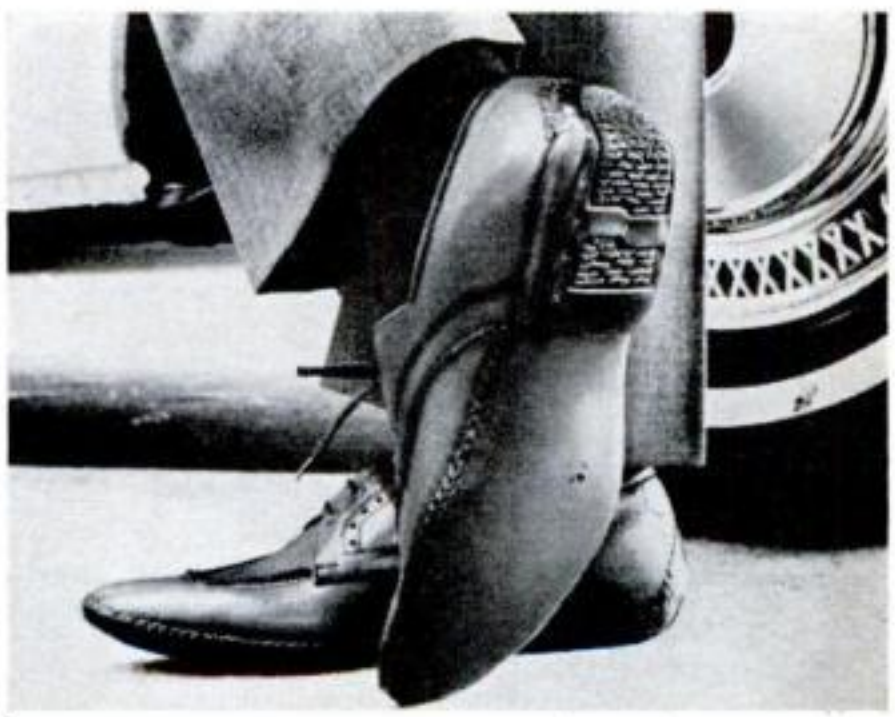
It Keeps Your Battery Warm on Cold Days

Have trouble starting on icy mornings? Your problem may be a chilled battery that's too weak to turn over a cold engine at proper cranking speed. To cure it, install this warmer under the battery and plug it into the nearest 110-volt outlet. Its nichrome heating element will boost battery temperature to 60 degrees on a sub-zero day. $6.95. Stadri Products Co., Whitestone 57, NYC.



Emergency flasher also tests stoplights

Flip the switch to "Emergency" and this breakdown signaler flashes your car's left and right turn signals simultaneously to warn away other drivers. Flip the switch to "Test," and it checks the stoplights. Its pilot light flashes if they are okay; it glows continuously if either bulb is burned out, or the wiring is faulty. Price: $8.95. American Safety Equipment Corp., 261 Madison Ave., NYC.



This shoe keeps a driver well heeled

Here's a shoe designed especially for men who drive a lot. It's made of soft, lightweight leather, and features a serrated rounded heel that cushions its wearer's feet when he's stepping on the accelerator. The rounded heel also cuts down wear and tear on the floorboard and rug under the pedals. Cost: $19.95, with either traction rubber bottom or leather heel and sole. Fellman, Ltd., 6 E. 46 St., NYC.

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Rule 1: Surface must be clean. Dirt, oil, and tarnish won't let solder stick, must be removed. It's then up to the flux to keep the surface clean as it's heated. Solder that flows on smoothly like this signals a job well done.

Whether you're a pro or a beginner, you'll do a better job if you remember—

The FOURTH Rule

By John Burroughs

MOST of us know the first three rules for good soldering: a well-cleaned surface, the proper heat, and the right solder and flux. But there's a *fourth* rule that's just as important, yet is often overlooked.

It's simply: Never rely on solder to *hold* things together. This may sound odd, but it's true. Solder is primarily a filler, *not* an adhesive. Solder's worst shortcoming is its poor structural strength. When you try to make it do the job of a mechanical bond, you're playing right into this weakness. This is seldom mentioned in instructions for the beginner, but it's heavily stressed in engineering manuals by the boys who know.

Not only is solder weak to begin with, but it can lose three-quarters of its initial strength through aging under stress. For this reason, it's important not to put it under stress. Be sure you have a strong mechanical joint *before* you apply the solder. This means twisting wires tightly around terminals when making electrical connections, or using interlocking seams in sheet-metal work. In some cases, it may be necessary to rivet or bolt the parts together before soldering.

For proof, take a close look at the beautifully soldered joints you find in antique cookware made by early American metalsmiths. These pieces have lasted two centuries and more because their joints were riveted or lock-seamed before the solder was applied. The solder was used merely as a filler and a smoother—and this is its real value. What solder does is stabilize a

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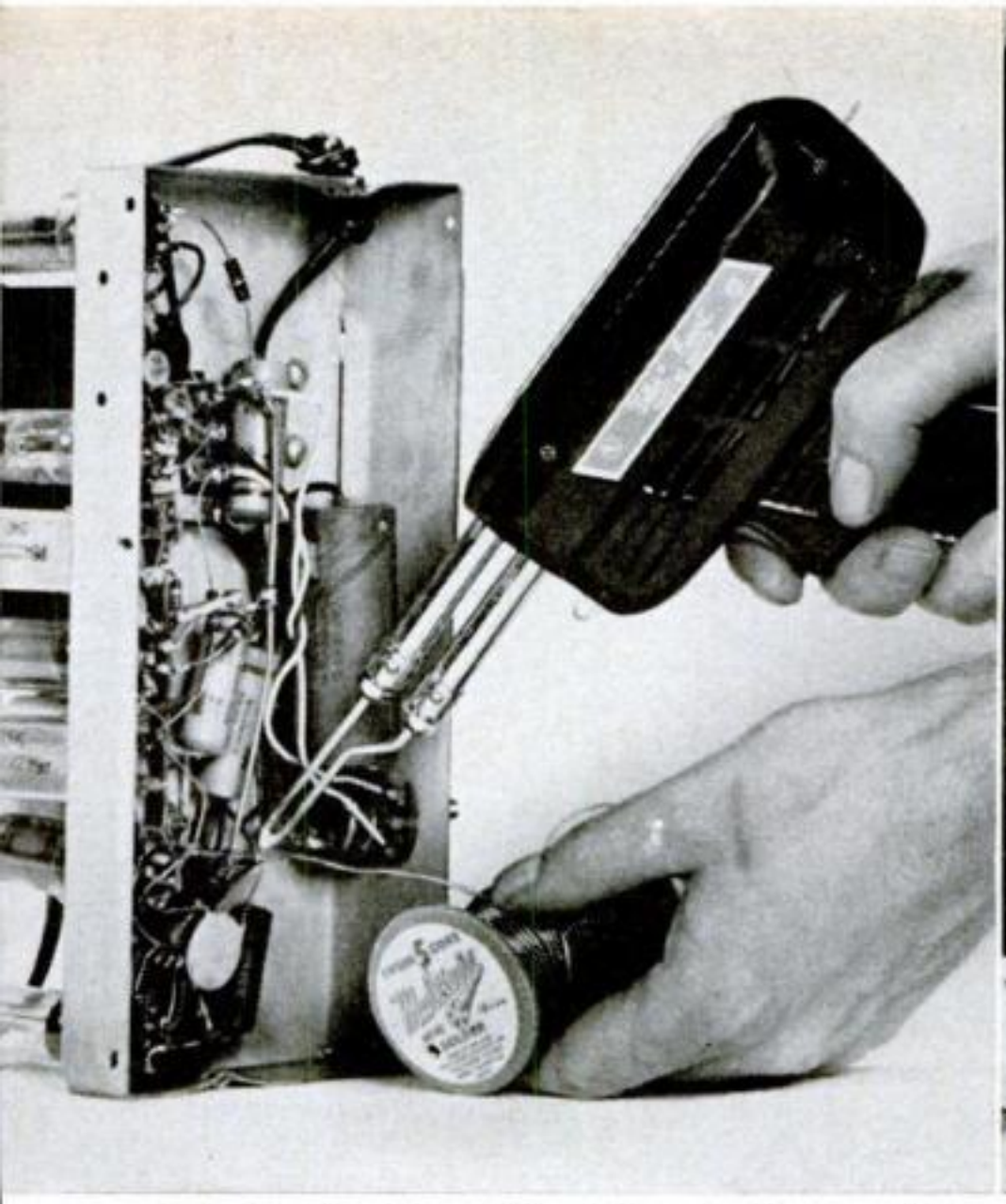


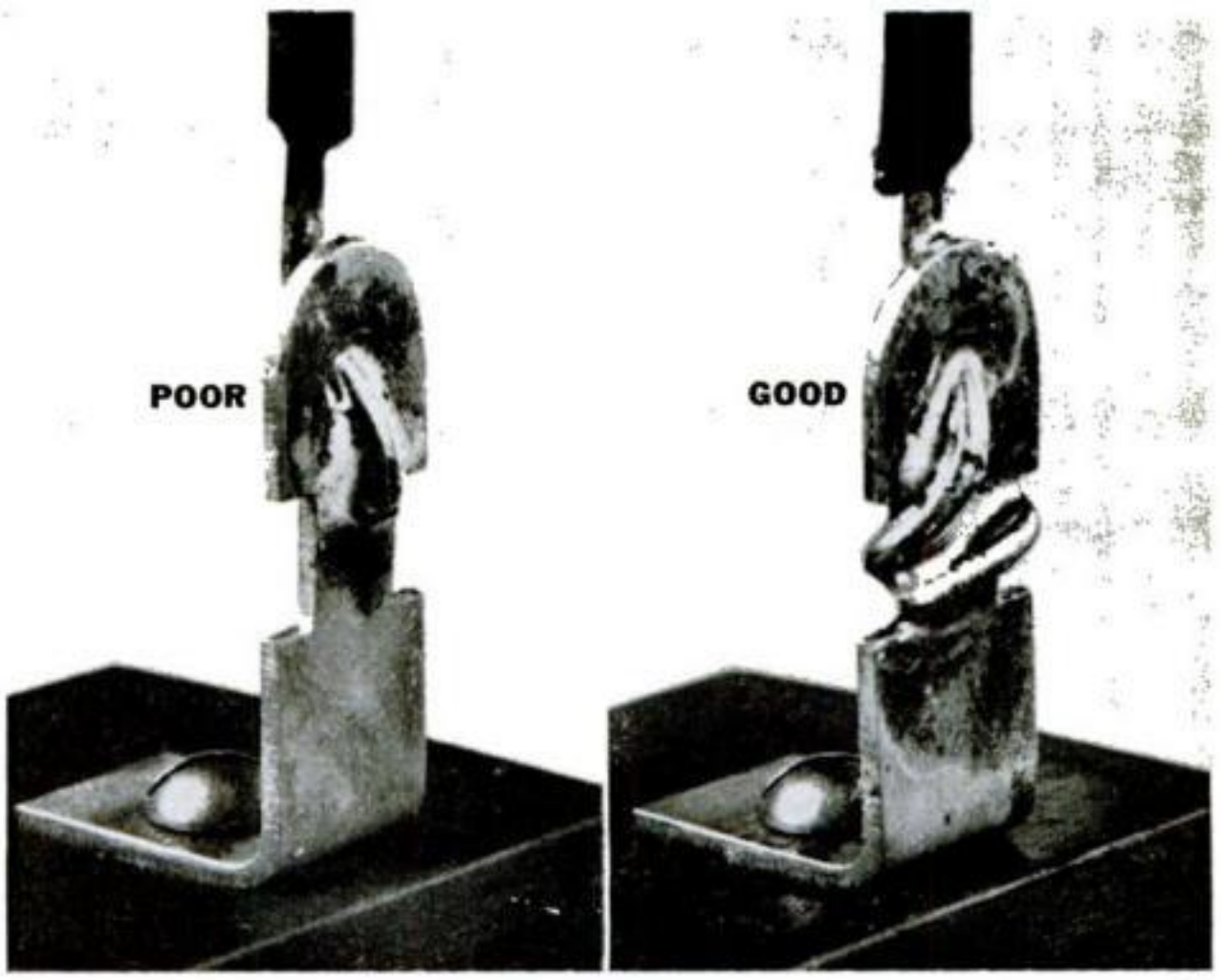
Rule 2: Use the right solder. Acid-core solder would quickly corrode connections in this radio chassis. For delicate wiring, you need non-corrosive rosin-core type. But acid-core stuff is right for heftier jobs on ferrous metals.

Rule 3: Enough, but not too much, heat. For big-area jobs like patching a pot, you need the broad, intense flame of a torch. But by the same token, a torch is too hot for many small jobs where a gun or iron is the better choice.

for Soft Soldering

The FOURTH Rule...

Be sure the joint is strong before you apply the solder. A joint that relies on solder alone to hold it is weak. The soldered terminal connection at near right is poor because the wire is merely pushed through the terminal's hole and can pull out easily. The joint at far right is good because the wire is wrapped one full turn around the terminal's shank and can't pull loose even if the solder lets go.



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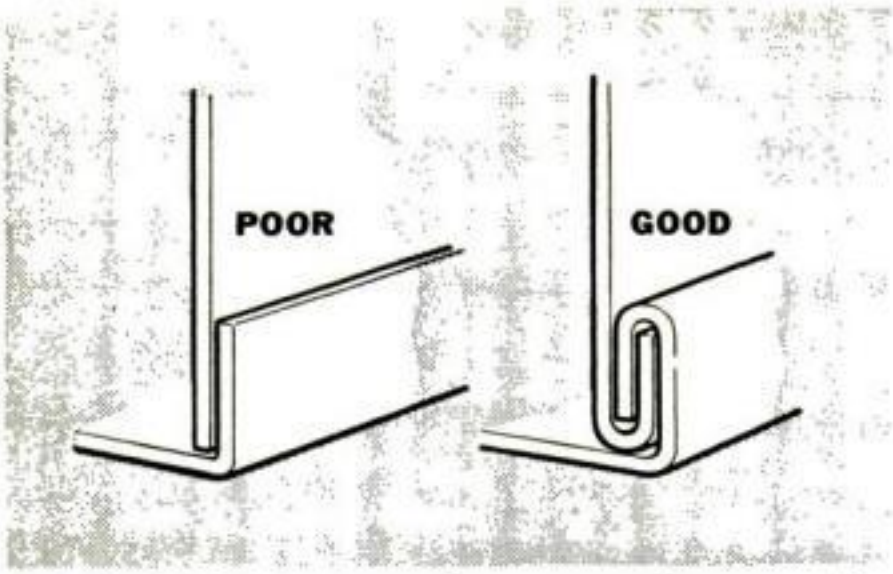
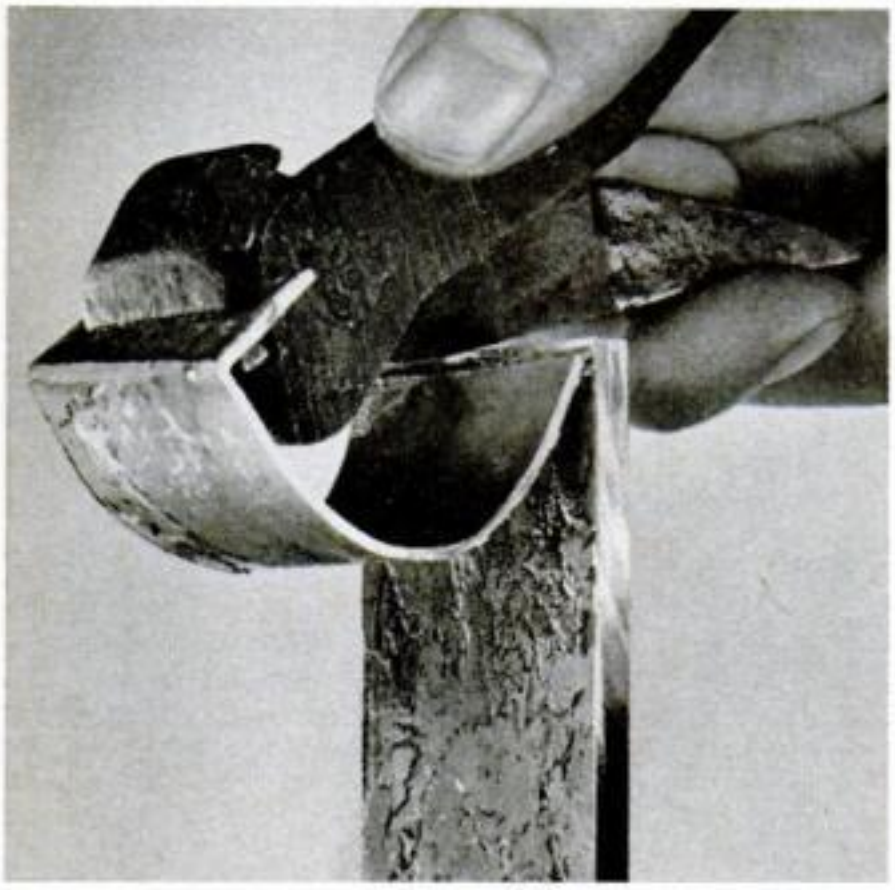
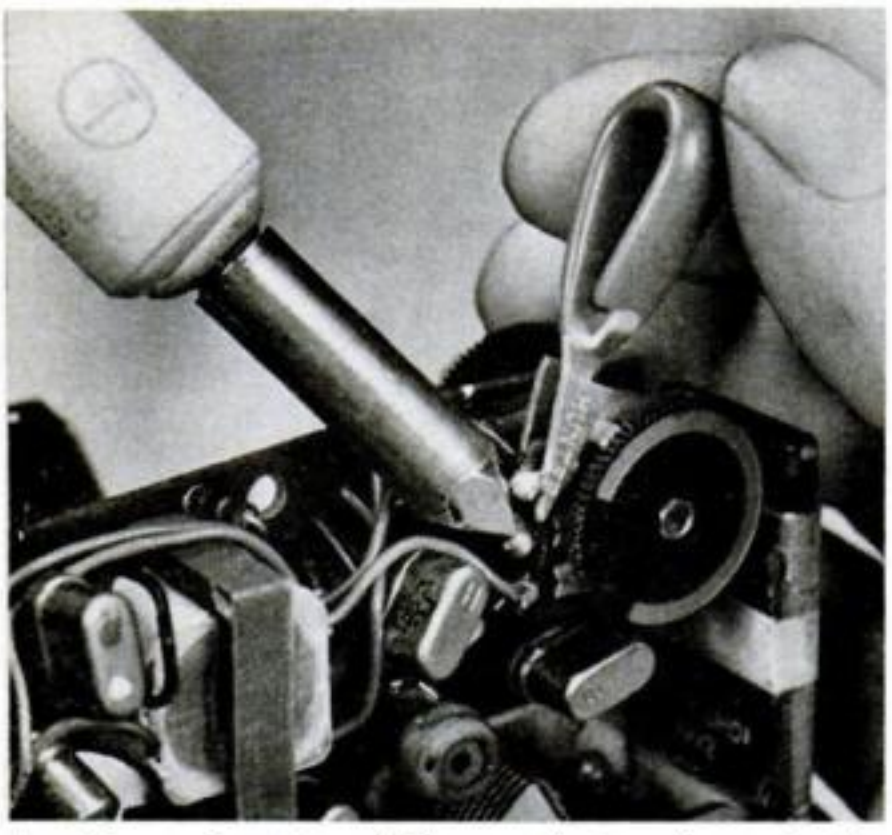


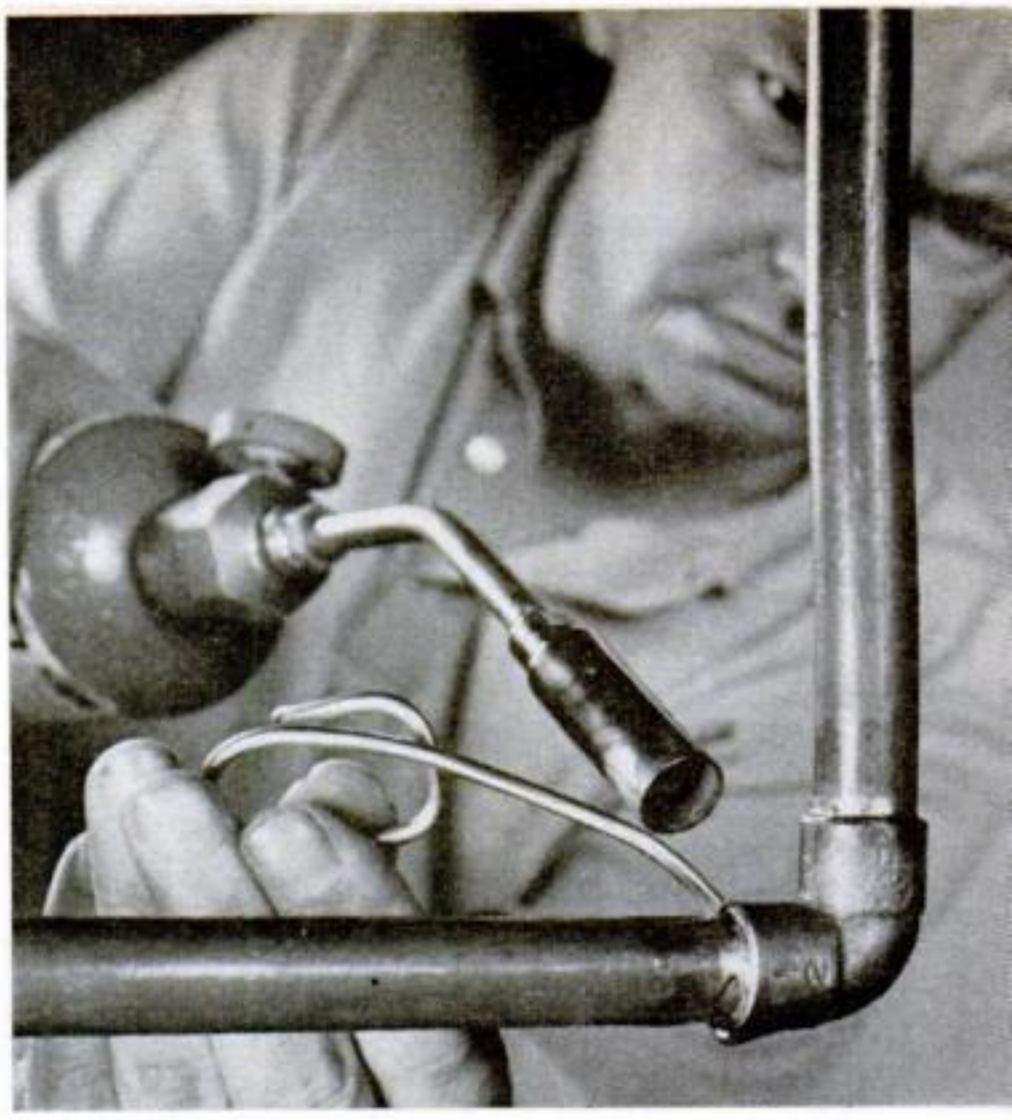
Interlocked joint, as above at right, provides a strong mechanical bond that doesn't depend on solder for strength. Simple lapped joint at left can easily peel apart under a strain.



A typical sweated joint looks like this when pulled apart. Tiny bubble voids in the solder are harmless if they're evenly distributed and cover no more than 15 percent of joint's area.



Avoid overheating delicate electronic parts, by using a heat sink. This tiny beryllium-copper clip attaches to wires or terminals to draw off excess heat and thus protect other parts.



Sweating a joint is easy if you remember to heat it well first. Then merely touching solder to the joint will cause it to be drawn readily into all crevices by capillary action.

joint, hold the parts in tight contact, insure a good electrical bond, and even act as a waterproofing sealant. To expect more is asking for trouble.

Why solders differ. Solder is a mixture of tin and lead because lead alone will not "wet" or adhere well to other metals. It's the tin that "tins," or coats, the work, forming a close, tight bond. While lead is chemically inert, tin is so active it will dissolve other metals with higher melting points, providing a grip for the lead.

Because tin and lead have different melting points, varying the proportion of one to the other changes a solder's melting range—the temperature span through which it remains soft and plastic. High-lead solder—30 percent tin to 70 percent lead—has a broad melting range and remains pasty for a long time. This makes it useful for jobs like auto body filling where a patch can be smoothed and shaped while the solder is setting slowly.

High-tin solder—60 percent tin to 40 percent lead—has a narrow melting range and cools and sets quickly. Called quick-freezing solder, it can be a big help where you have a lot of difficult joints to make and want them to harden as fast as possible. High-tin solder also melts at a lower

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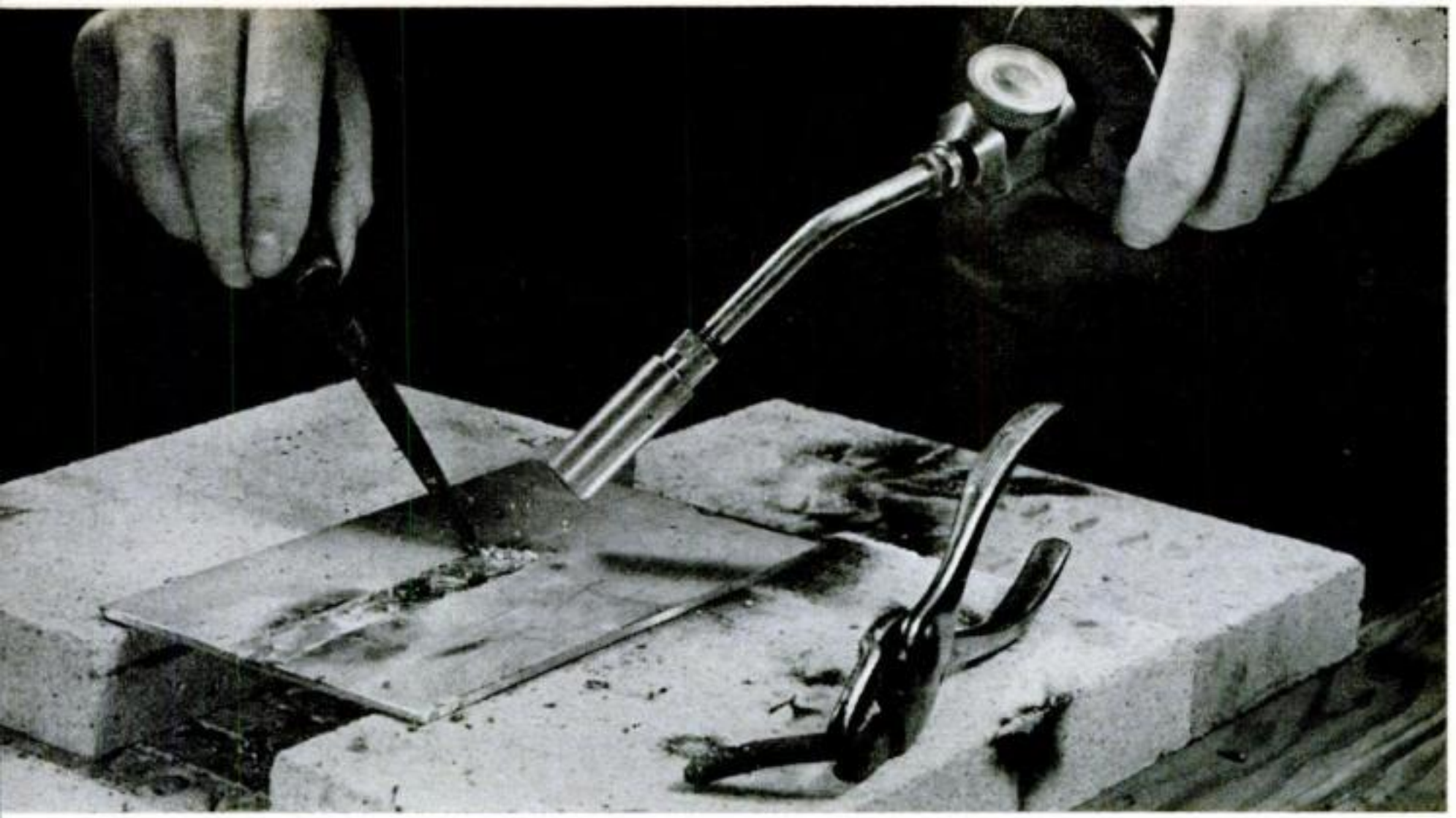

Special tin-zinc solder makes it easier to solder aluminum, normally tough because of the hard oxide film that forms. Another helpful trick: Melt a puddle of solder, then scrape through it into the surface to break up the oxide until the solder adheres. Job takes high heat. Once tinned this way, aluminum can be soldered with a regular tin-lead alloy.

temperature than tin's own melting point. This enables it to solder tinplate without melting off the tin.

General-purpose solders use either a 40-60 mixture of tin to lead or a 50-50 mix of tin and lead. For special jobs, there are also solders with different ingredients. A tin-zinc mixture will adhere to aluminum where the normal tin-lead alloy won't. A tin-indium combination will solder metal to glass.

The right heat. When solder melts in contact with a hot base metal, it actually eats into it, diffusing into the metal. The higher the heat. the deeper the solder penetrates.

This would lead you to believe that the more heat you use, the stronger the joint. But it isn't true. When solder bonds with a base metal, a layer of alloy-like metallic compound forms between the two. This layer is crystalline in structure and is hard and brittle. It's along this brittle layer that soldered joints fracture or peel. The higher the heat, the thicker this layer and the weaker the joint.

This is why soldering heat can't be too high. It can't be too low, either, or the solder won't wet the work properly and an

[*Continued on page 196*]

Tinning an iron—melting a thin layer of solder on the tip—helps transfer heat to the work, is important. Rub the tip in a drop of solder on a cake of sal ammoniac. Re-tin frequently.

WHICH SOLDER FOR WHAT?

TIN-LEAD COMPOSITION (% by weight)	MELTING RANGE TEMPERATURES (degrees F.)	WHERE USED
30-70	361-491	High-lead alloy for auto body filling and wiped plumbing joints
40-60	361-455	General-purpose alloys for sweating and soldering galvanized roofing, copper tubing, etc.
50-50	361-421	
60-40	361-374	Quick-freezing, low-melting-point "tinner's" or "fine" solder. Also radio-TV solder
70-30	361-378	High-tin alloy for soldering zinc and coating metals for corrosion resistance

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PS PROJECTS

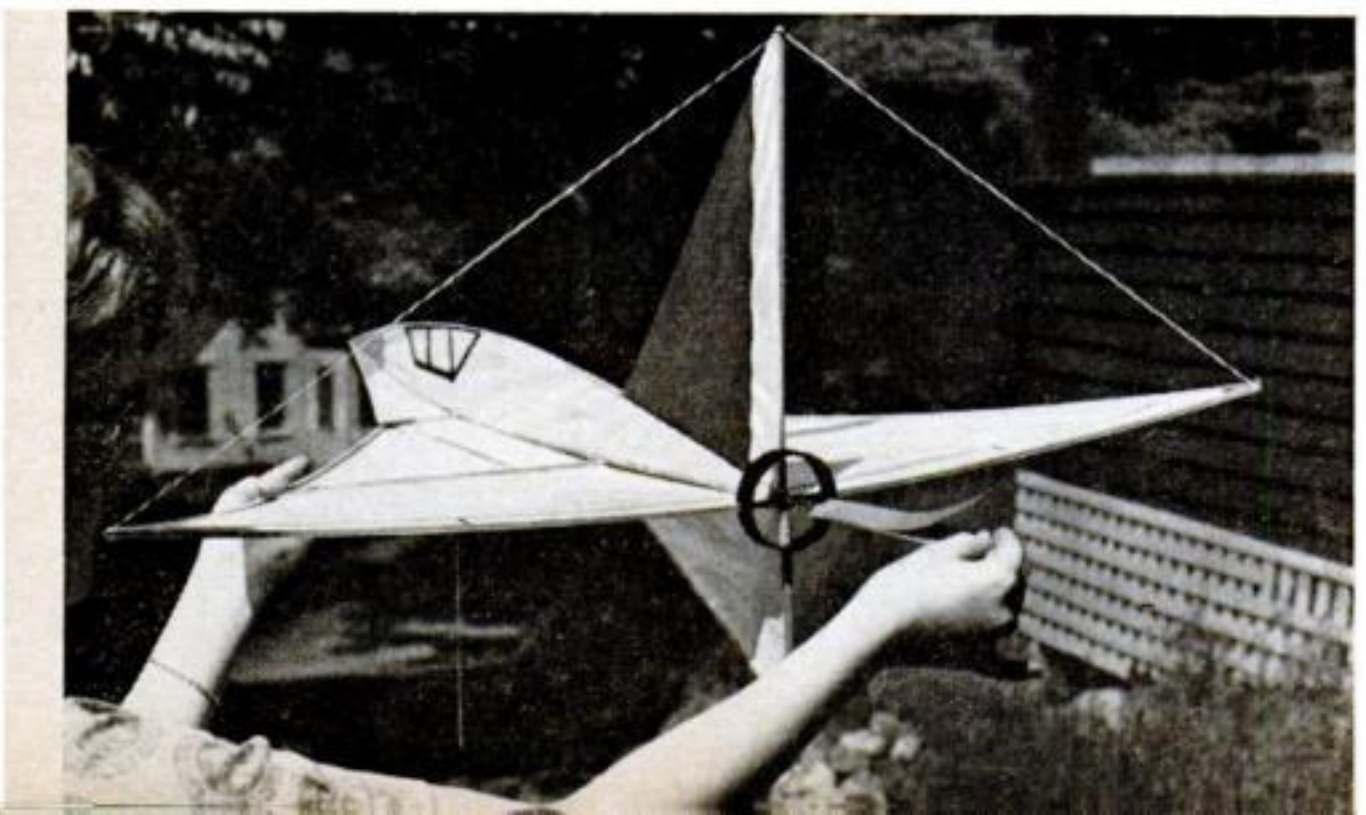
Here's fun at the end of a string:

A Jet-Fighter Kite

By Roy L. Clough Jr.

A DELTA-wing jet fighter on the end of a string, this spectacular kite will go up in the lightest breeze. A colorful tow-target sleeve and "flame" blasting from the tailpipe add to its realism.

The jet kite is easy to build—a perfect project for a dad with an air-minded youngster who is still too young for the exacting requirements of control-line flying. You can start it after supper, fly it the next morning.



Jet flame is simulated by a strip of orange paper at the rear of the kite, jet pipe by a section of mailing tube. Note how a string stretched over the top of the fin gives the required dihedral to the wings. About 2" is right for good flying.

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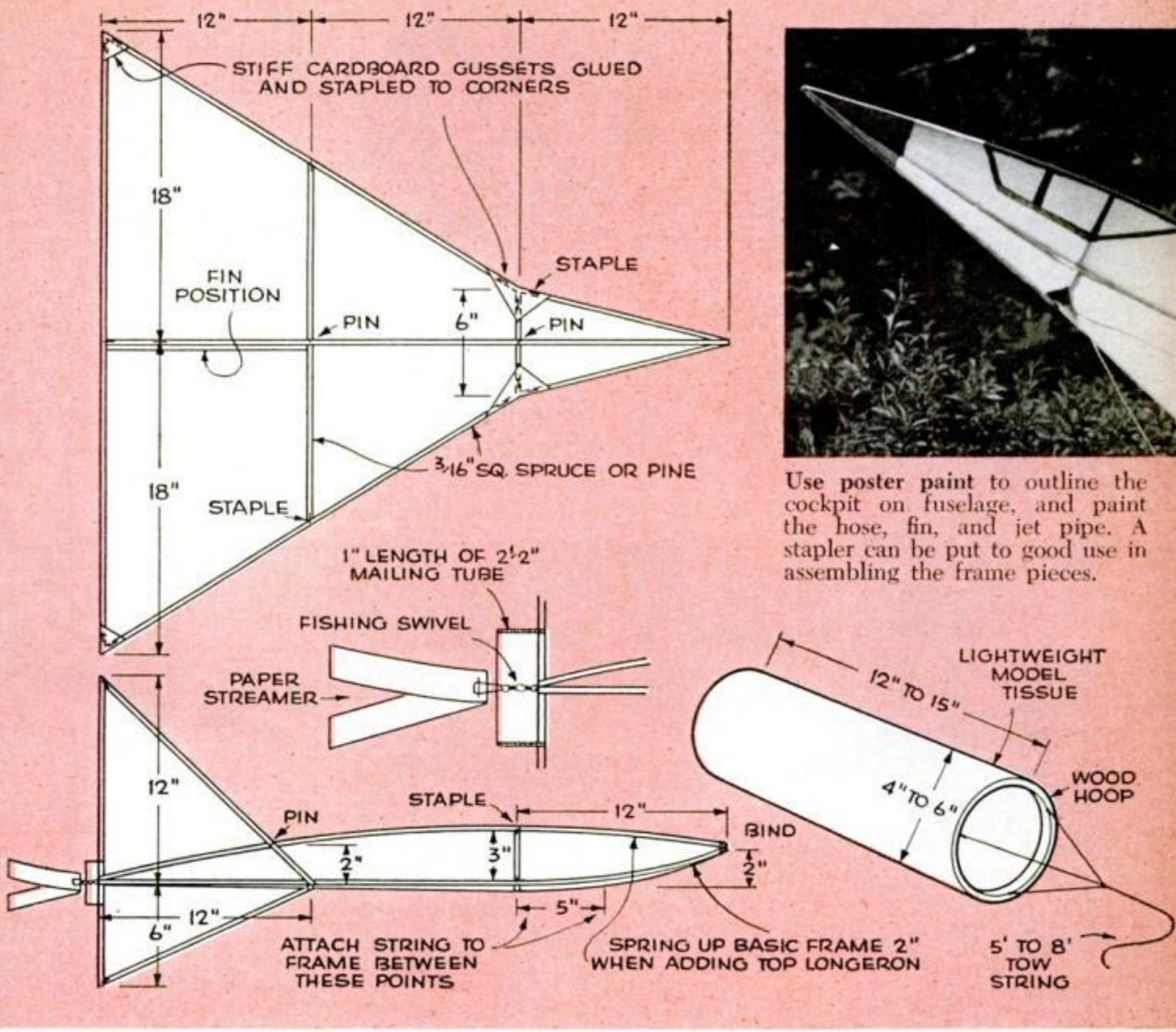

Use poster paint to outline the cockpit on fuselage, and paint the hose, fin, and jet pipe. A stapler can be put to good use in assembling the frame pieces.

The frame should be 3/16″-square sticks of spruce or white pine, although very hard ¼″-square balsa will do. The frame corners are reinforced with stiff cardboard gussets. The fuselage is a profile structure built atop the wing frame, a framing member being sprung from front to back. Make certain that fuselage and fins are true, without offsets of any kind. Cover with heavy-grade gas-model tissue. Do not dope the tissue or shrink it with water. Details and decorations can be put on with poster paint.

Run a string from wingtip to wingtip over the top of the fin and pull it up tight enough to put about 2″ of dihedral in the wing. The jet tube is a 1″ length of 2½″ paper tube, notched and glued to the trailing edges of the wing and fins. The "flame" is a 1″-by-10″ strip of orange construction paper, folded and attached to the frame with a fishing swivel. In flight, it spins rapidly with a rushing noise and the appearance of a jet blast.

The tow target is made from a hoop of thin wood covered with a sleeve of colored model tissue. (Soak a 1/16″-by-1/4″ strip of white pine in hot water, wrap it around a half-gallon jug, tie the ends together, and let dry.) The tow line is attached to the top of the plane's fin. The tow target's drag will steady the flight of the kite if you wind up with a slight imbalance.

The tether string is attached to the bottom fuselage member between the points shown on the drawing. The farther forward the string is attached to the fuselage, the shallower the angle of flight. Adjust it until you approach a horizontal angle.

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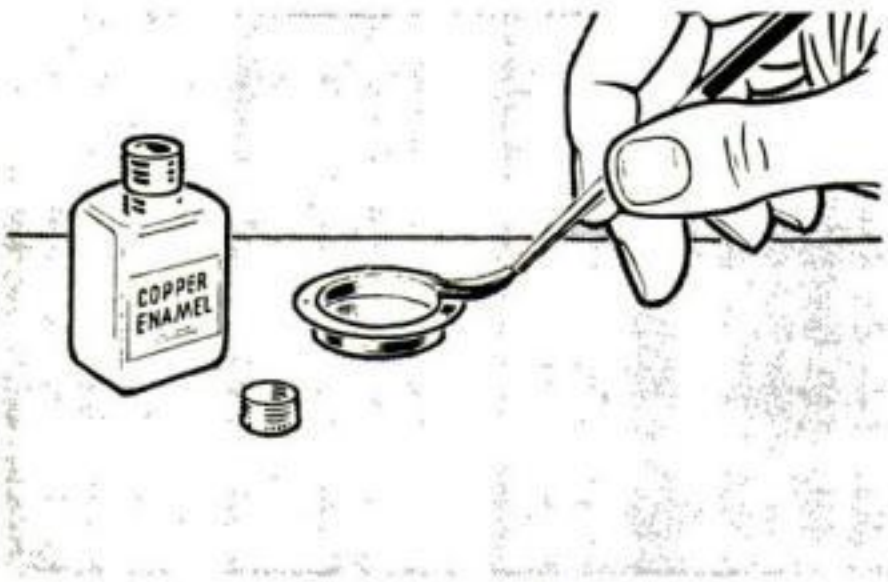
Short Cuts and Tips FROM PS READERS

How to improve footwork in table tennis

If your guests tend to slip on a smooth floor while playing table tennis, put down a large sheet of polyethylene at each end of the table, anchoring it under the legs. The plastic will also save the flooring from wear.—*Ken Murray, Colon, Mich.*

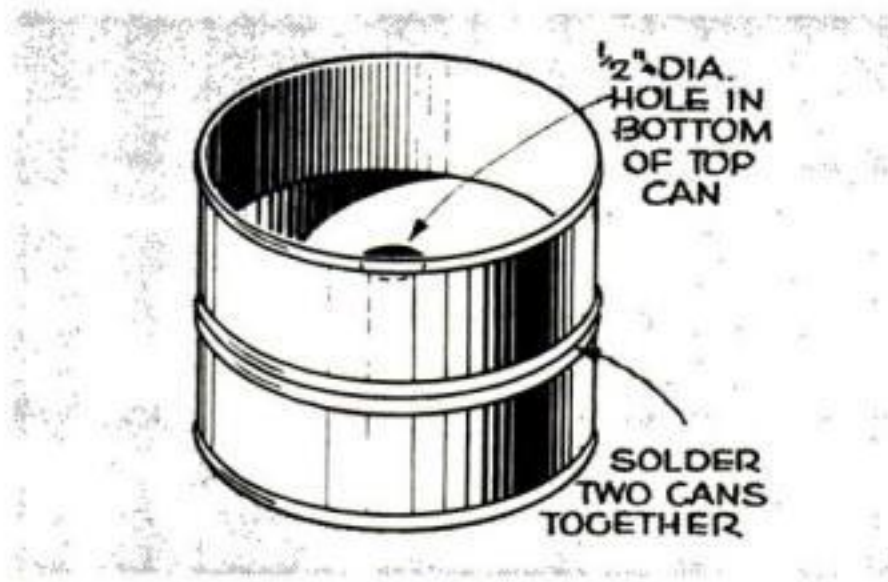
Coil spring protects cable release

A small spring slipped over a camera cable release will keep the sheathing from breaking. The spring-fitted release above has been in use for five years. Before I hit on the idea I had to discard several releases because of breakage near the camera end. The spring makes the cable easier to use, too.—*H. J. Gerber, Menomonie, Wis.*



Make your own "copper" door pulls

If you pick copper hardware for kitchen cabinets, you may be disappointed to find that recessed finger pulls for sliding doors usually are available only in brass or chrome. You can solve the problem by buying a small bottle of copper enamel and applying it with an artist's brush. First rub the surface of the pull with fine emery cloth to give the enamel a "bite."—*Ralph S. Wilkes, Keuka Park, N. Y.*



Here it is—a nonspill oilcan

Two shallow cans soldered together make a handy oil container for use in a machine shop. Sliced-pineapple cans with the tops removed are ideal. Flatten the circular ridges in the bottom of one so the bottom bulges downward. Cut a small hole in the center of the bulge; solder this can on top of the other. Keep oil in the lower can, dipping it out with a brush as you need it.—*E. Lord, Santa Monica, Calif.*

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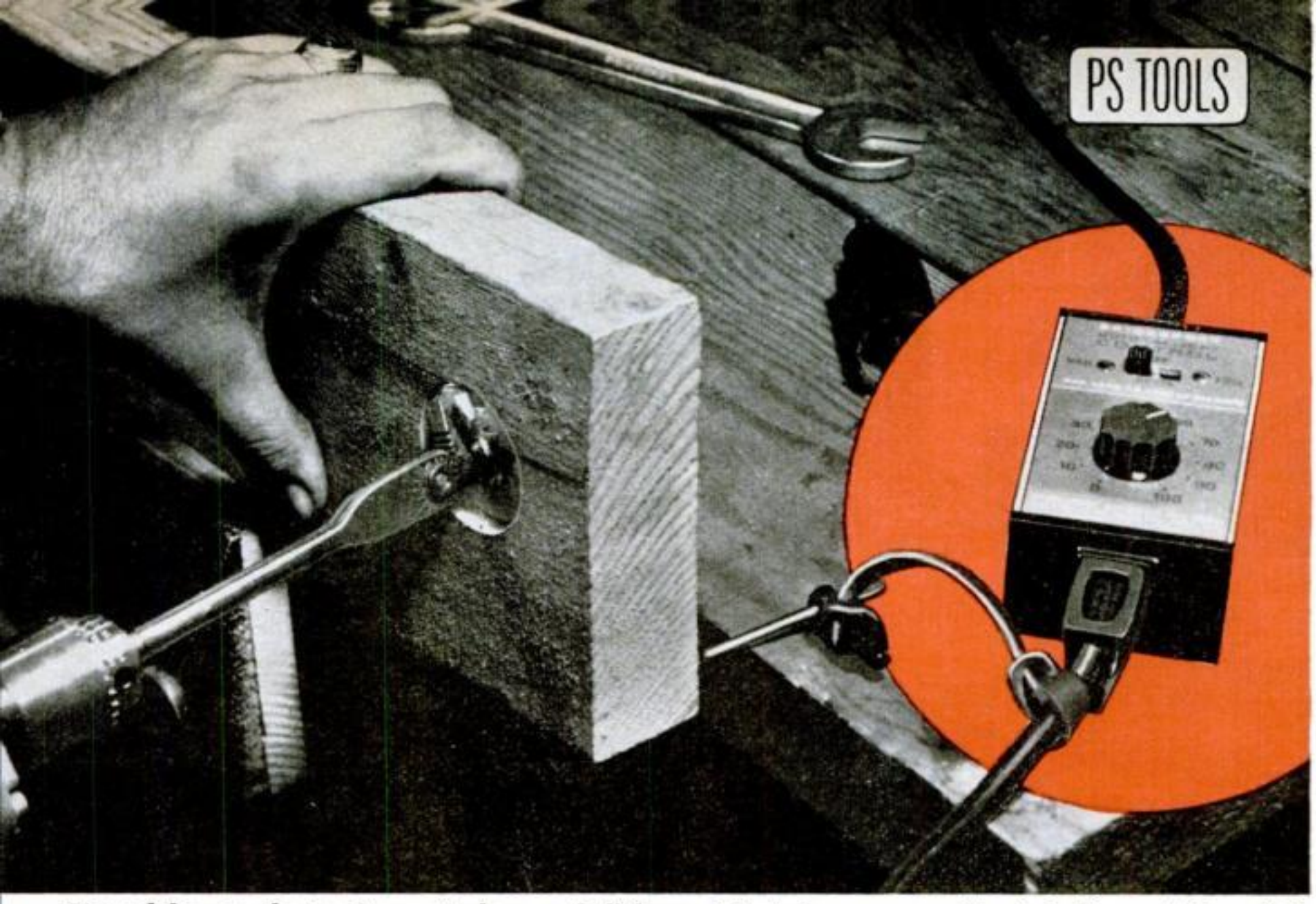

Tamed by an electronic magic box, a drill bores big holes more easily at half speed than full.

You'll get more out of your portable tools if you hook them to one of—

Those Amazing Speed Controls

By Darrell Huff

THOSE tiny electronic controls that let you dial the speed of a power tool have blossomed almost overnight into one of the most exciting developments in shop equipment. Introduced only a little over a year ago, these clever gadgets are already available in dozens of types and in a wide range of prices.

What can one of these little boxes do for you? Is it worth the money? How do you choose the right type? They aren't all alike, and there are important facts you should know about what they will —and won't—do in your home or shop. Here are the answers:

Why they're good. At a half or quarter of its normal speed, an electric drill does many jobs better. A typical 2,000-r.p.m. ¼" drill slowed to 500 r.p.m. takes on many of the characteristics of a powerful ½" drill. It can make large holes more smoothly and cleanly. It can bite better into tough materials like hardwood, metal, and masonry because it isn't wasting power "spinning its wheels." Drill bits cut more efficiently and last longer with less dulling.

The same holds true of a saber saw. Hard materials like steel are often cut more

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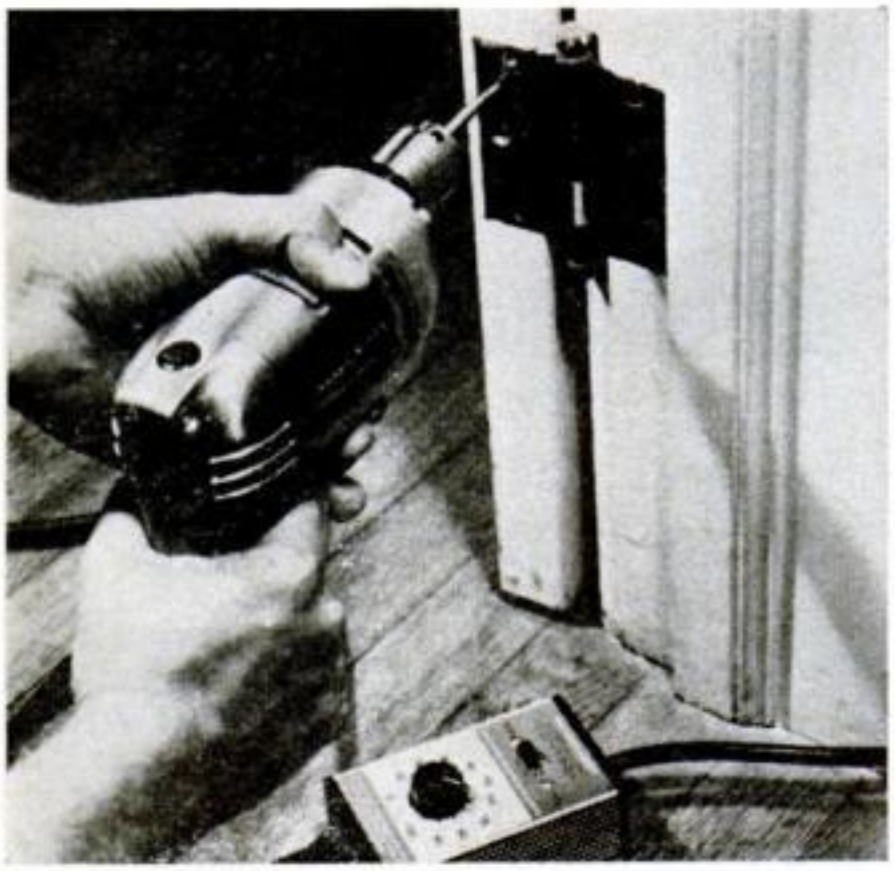
Splashless paint mixing is easy with an electric drill at about one-fourth normal speed.



Slowed to a crawl, a drill becomes a power screwdriver. Control is a 7½-amp Bridgeport.

A kitchen blender handles heavy mixes more easily, splatters less when throttled down.

easily at a low speed than a high one. And it's practically impossible to cut very soft materials—like aluminum, which clogs blade teeth, and plastics, which tend to melt from heat caused by friction—unless you can throttle down.

What the new electronic speed controls do is let you slow down a tool *without losing power*—and this is important. You can slow down a motor merely by reducing its voltage, but that's no help. Under load, the voltage-starved motor simply slows down further and loses its ability to do any work.

The electronic controls let you set a motor to any desired speed; then they keep it at that speed by automatically feeding it more power whenever it starts to slow down below the preset level. Thus the motor always operates at full power regardless of what speed it's set at. It's this full power, plus low speed, that enables a tool to bull its way through steel plate and solid concrete.

The speed controls can also be used to dim lights and to vary the temperature of resistance-type heaters, such as soldering irons. Photographic floodlights can be turned down low until you're ready to shoot, saving wear and tear on both lamps and subject. Lowering the heat of a soldering iron can be helpful on delicate jobs, such as printed circuits, where a hot iron might damage electronic parts. Certain household appliances, such as kitchen mixers and fans, also become more versatile when hooked to a speed control.

What they won't do. Electronic speed controls work only with small brush-type universal motors. They won't work with large motors used in table saws, drill presses, and other stationary power tools. That is why they are largely an aid to portable power tools. Since you'll pay from $10 to $30 for one of these little boxes, they're a wise investment only if you work regularly with portable tools.

Don't buy a control to make a tool go faster than it already does. A control can only slow a tool to less than its normal speed. If you plan to use a control for soldering, remember it will work only with resistance-type irons. It will not work with transformer-type guns. Also, it will work only for dimming incandescent lights, not fluorescents.

When you use a control, bear in mind that you are running tools and appliances

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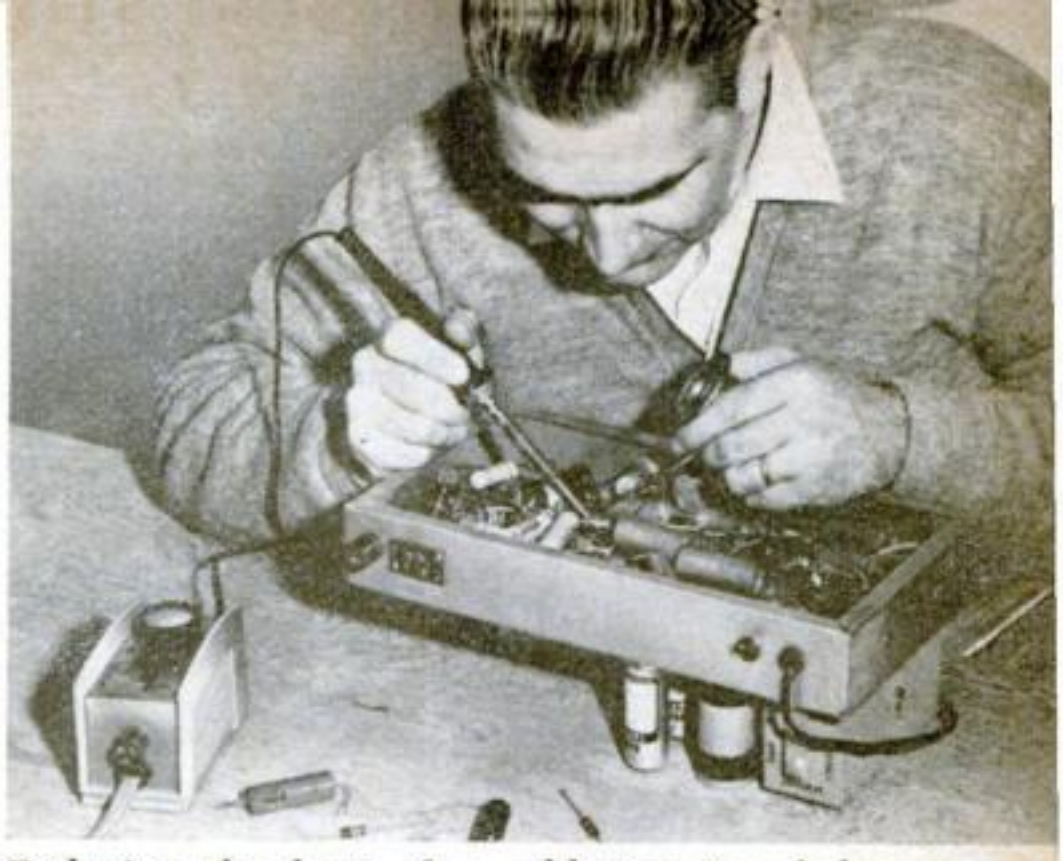
at speeds they weren't designed for. It's possible to overheat a tool when you run it slowly because its built-in ventilating system isn't pumping as much air. If you feel or smell a tool getting hot, take it out of the work and run it at full speed for a few minutes. This will cool it faster than shutting it off.

Choosing the right type. Don't be confused by the kind of control that's sold as a light dimmer. This is designed for lights only and does not contain the necessary circuitry to handle motors. Be sure the control you buy specifies both motors and lights, and incorporates a silicon-controlled rectifier—the essential ingredient in all motor speed controls.

Also, while all motor controls will handle lights, not all will do the job equally well. Lights have a tendency to flicker at low-intensity settings because the silicon-controlled rectifier works by interrupting the current so it flows in on-and-off pulses. The lower the setting, the longer the interruptions. While this isn't a serious problem, some controls incorporate a flicker suppressor. If you're going to use a control for photographic or other critical lighting, it's worth the few extra dollars to get one with this feature.



Reducing the heat of a soldering iron helps protect delicate electronic parts that might be damaged by a hot iron. Control shown here is a GE, handles five amps, sells for $17.95.

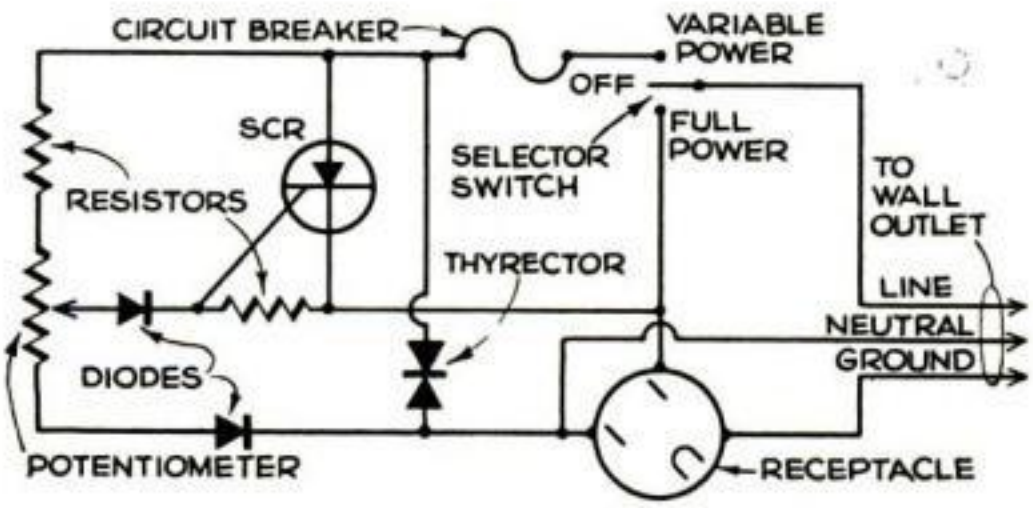
How much capacity? Speed controls come in different models capable of handling from three or four amps to 15 or

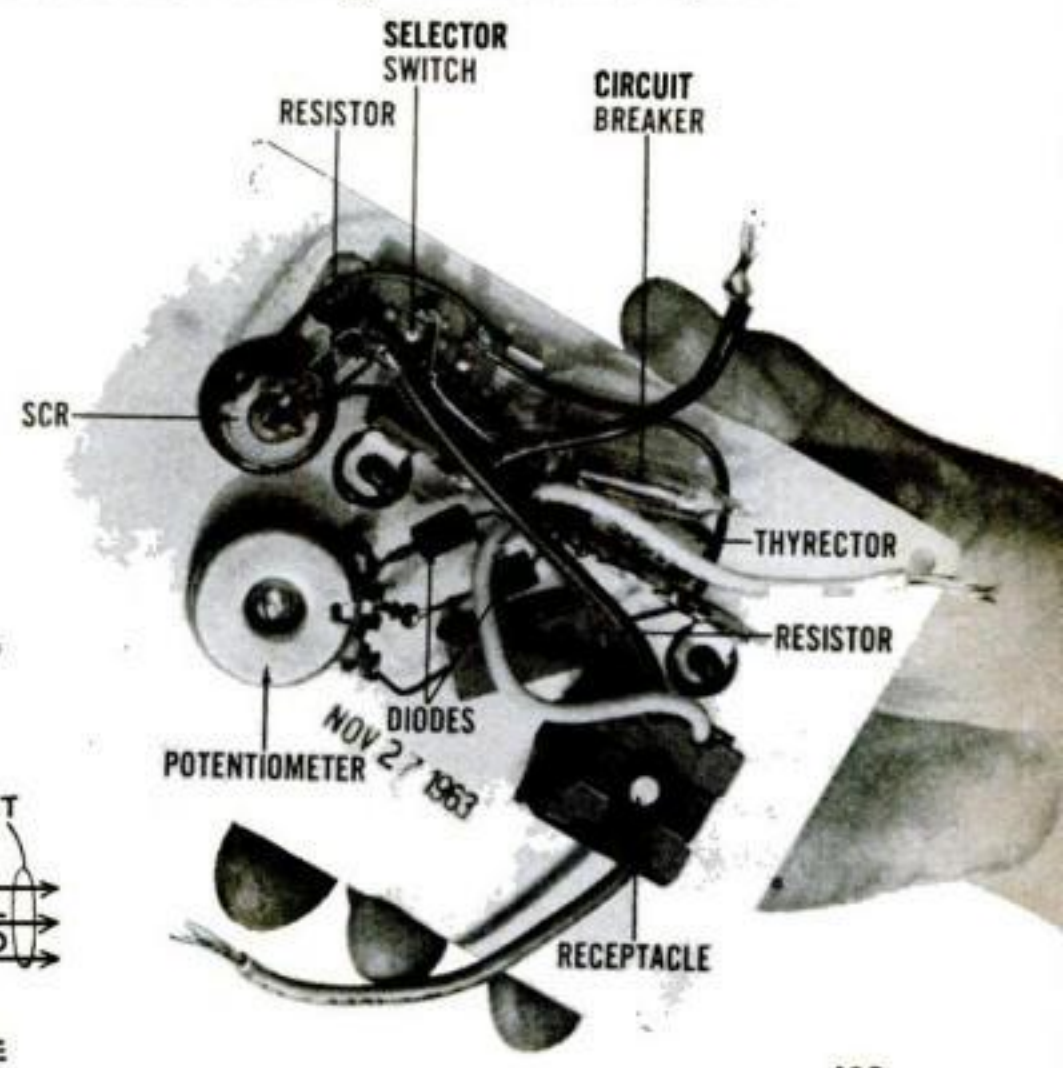
[*Continued on page 195*]

How electronic speed controls work

Only a handful of parts, a speed control consists basically of a silicon-controlled rectifier (SCR) and a potentiometer. The SCR changes AC line current to half-wave DC pulses. Acting like a rapidly opening and closing switch, it also varies the length of these pulses according to the point on each wave cycle at which it fires or closes, sending current to the motor. The earlier it fires, the longer the "on" pulses last and the more power the motor receives. The later it fires, the less power the motor receives.

The potentiometer adjusts the SCR's firing rate to give the desired motor speed. From then on, the SCR is triggered by feedback voltage from the motor's armature. If the motor slows down under load below the preset speed, its feedback voltage drops and the SCR automatically fires earlier to provide added power. This keeps the motor turning at the same speed.





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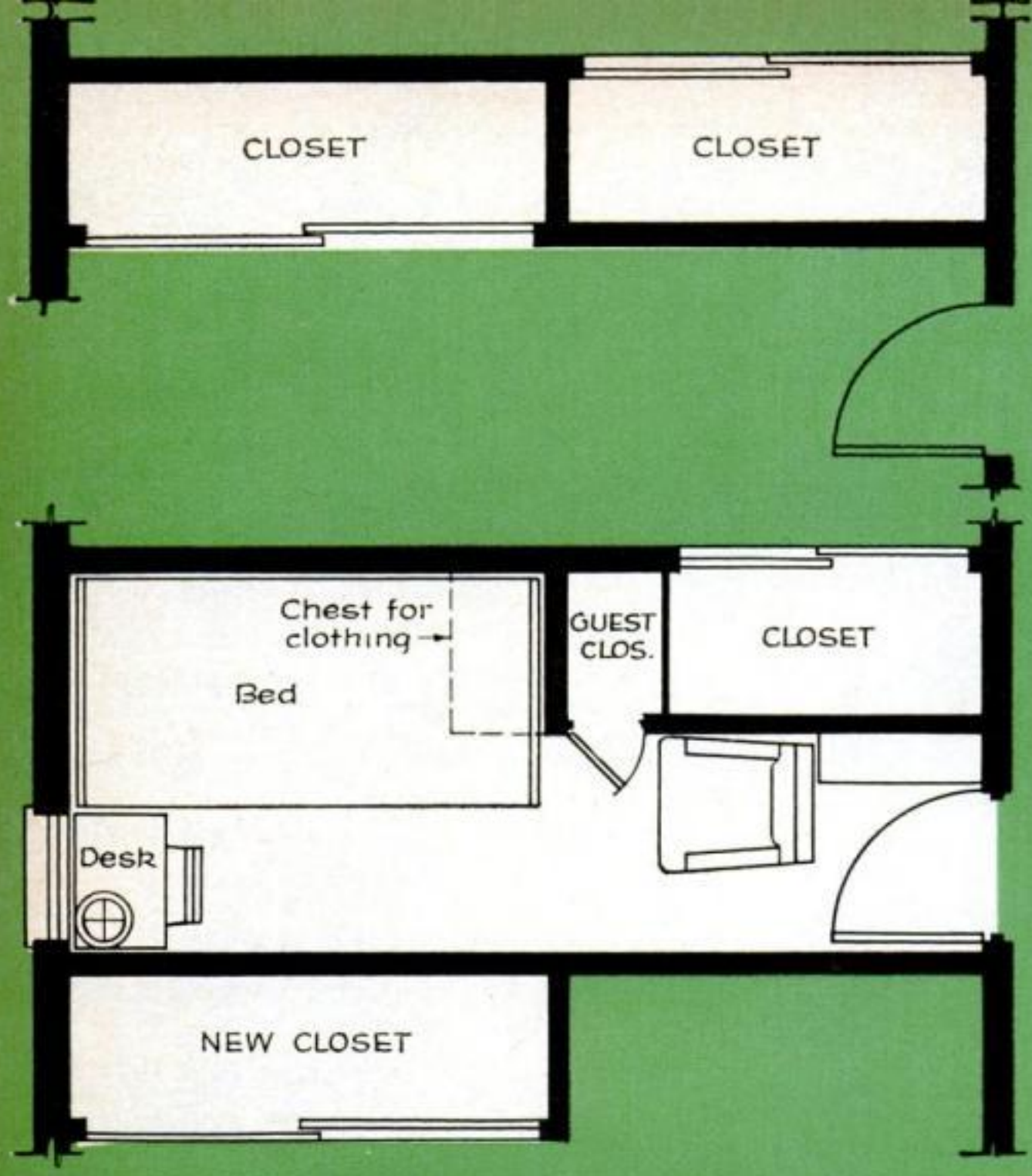

1 Squeeze a new room between two bedrooms

When two closets divide two large bedrooms, a guest room often can be carved out of the larger room by eliminating the closet opening into that room. Build a partition about 3' away from the remaining closet. Unless a hall door already is properly located, you'll have to cut one. Make it as narrow as possible, but no less than 2'. Put a 2' 2" or 2' 4" window in the outside wall by cutting away one stud. Then break into the back wall of the remaining closet between two studs and hang a door 12" or 14" wide, cut from ¾" plywood. Thus the guest room will have a closet for four suits or the equivalent. Locate a desk or dressing table under the window and hang a cabinet over the end of the bed. Finally, build a new closet in the room you've cut down.

The new tiny room could also be used as a child's bedroom, a sewing room, or isolation room for a sick child.

7 Ways to Find Space

By Carl T. Sigman

THE easy but expensive way to get more sleeping space is to buy a larger house or to add a room or two. But when you add, your mortgage may have to be rewritten, an architect must file plans, you need a building permit, and frequently a new hallway has to be cut out of an already too-small adjoining room to get at the new addition. Then the town reassesses the house and taxes go up. It also costs more to heat the larger house—with the heating plant probably overworking because it was designed for the smaller house—and some of the backyard is lost.

Before you take on all this trouble and expense, why not see what can be done about making better use of available space? Check over the entire house—first floor, basement, even that attic where you may have difficulty standing at full height. Sometimes you'll find a spot where a child can sleep temporarily, freeing an existing bed for a guest you want to pamper. All such remodeling jobs cost much less then adding a room. You can save even more by doing the work yourself.

This kind of improvement makes the resale value of your house considerably greater, probably without increased taxes. In case you sell you'll find many a large family needing badly just that extra sleeping space you have built in.

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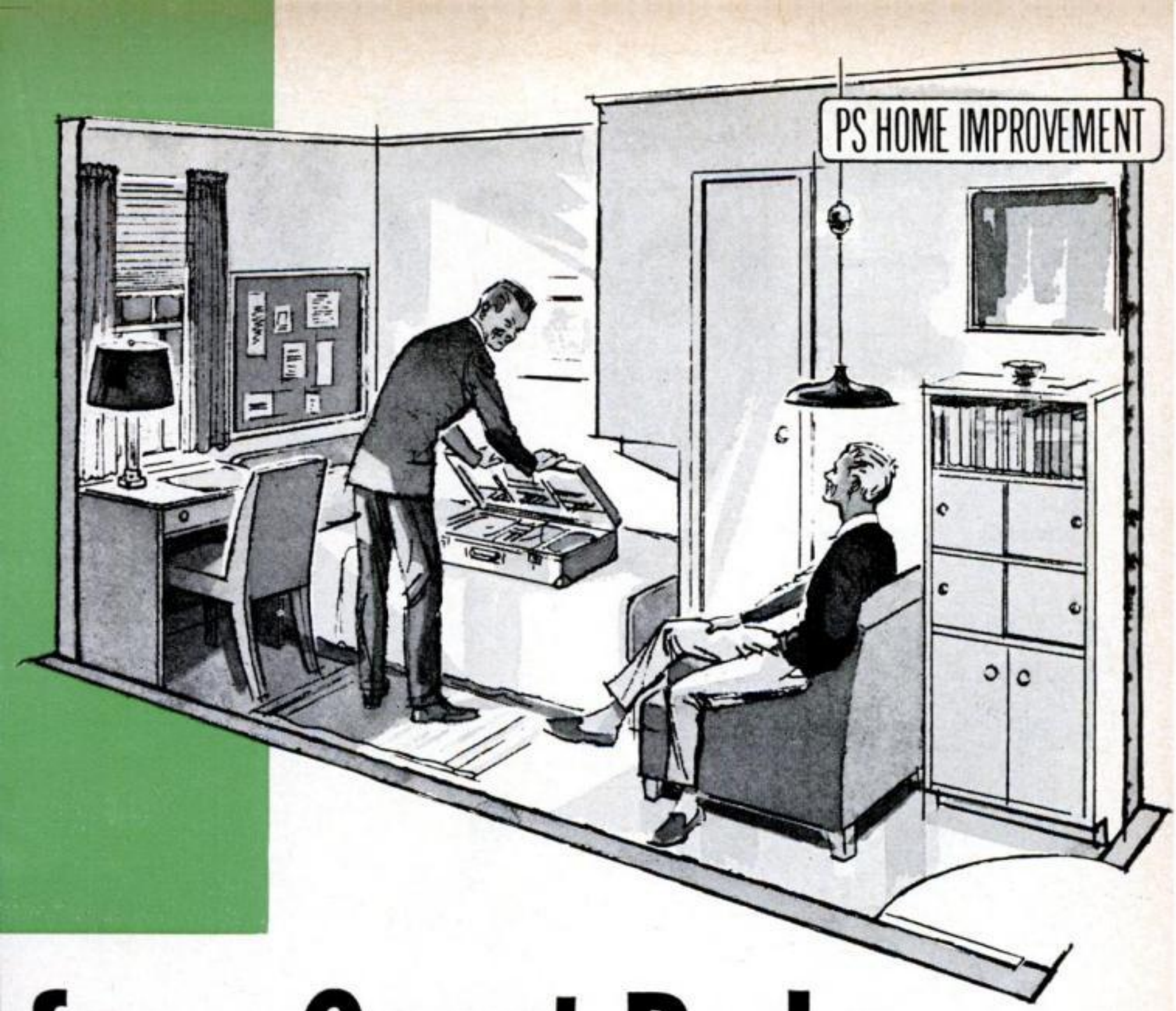
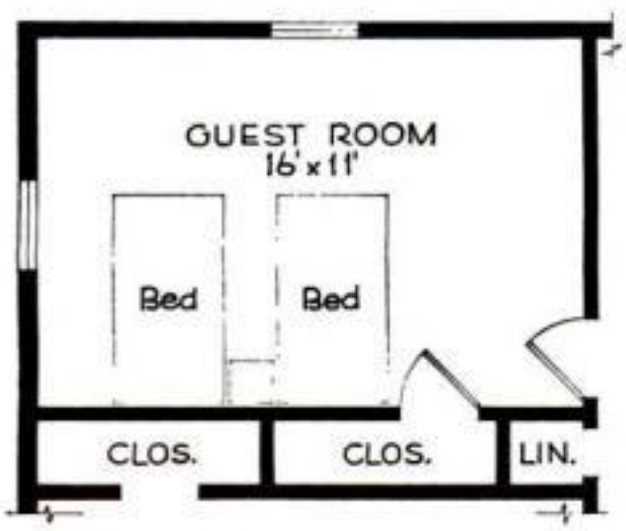


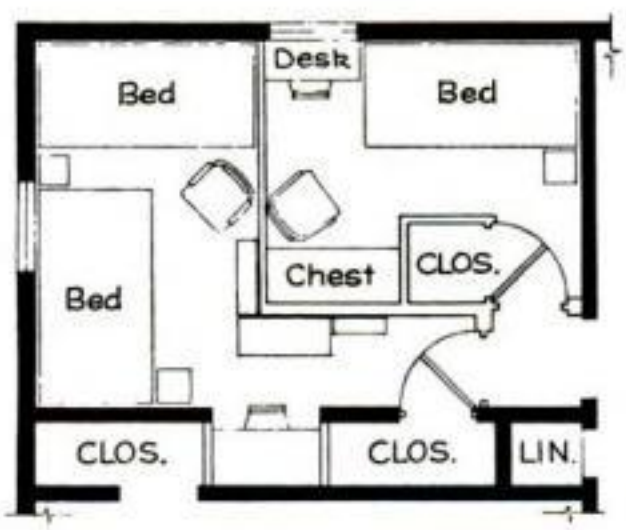
for a Guest Bed

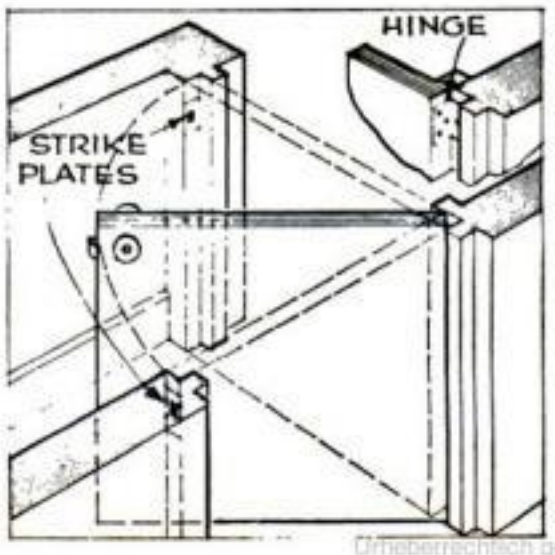
2 Divide a twin bedroom into two rooms with three beds

A corner bedroom like the one below at left is found in many homes. The center drawing shows how you can divide it into two small rooms, each with a window. You then have either a two-bed guest room and a child's room, or a guest room and a bedroom for two children. The original closets are made smaller to provide space for a vanity, chest, or desk.

The architect designed the room to make the two doors in the original room do the work of four, thereby saving the expense of two additional ones. The arrangement also avoids the inevitable bumping of bedroom and closet doors when the two are hung close together. The drawing at right shows how one door is hung to become both closet door and bedroom door. In one direction, the door closes normally. You simply push it shut. But when you want to close the other opening, you turn the knob and hold it until the latch (the flat side) has passed the striker plate and enters latch recess. CONTINUED







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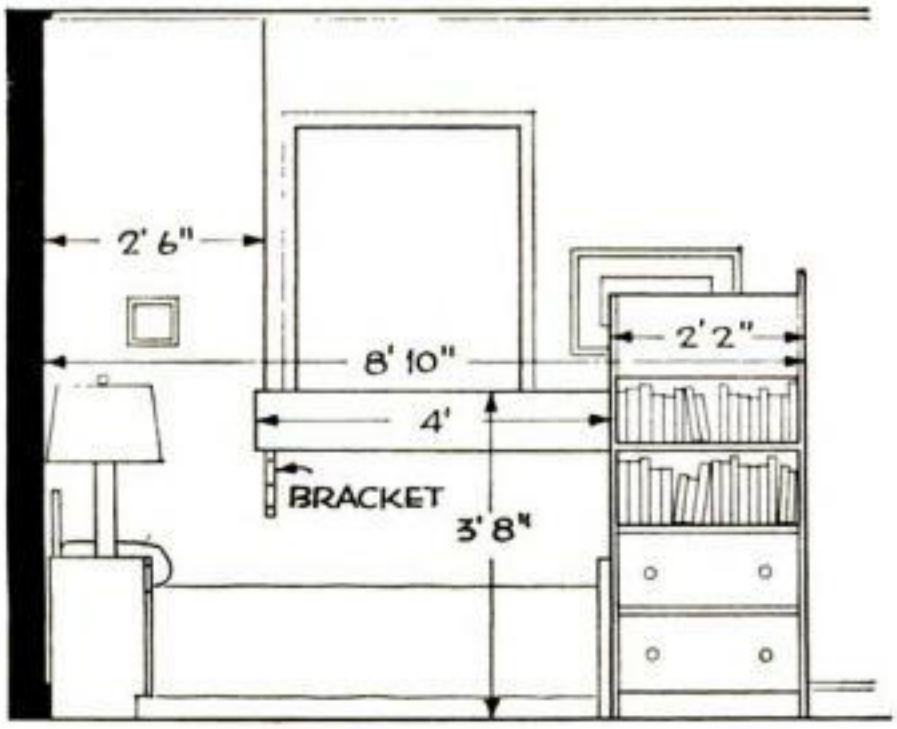
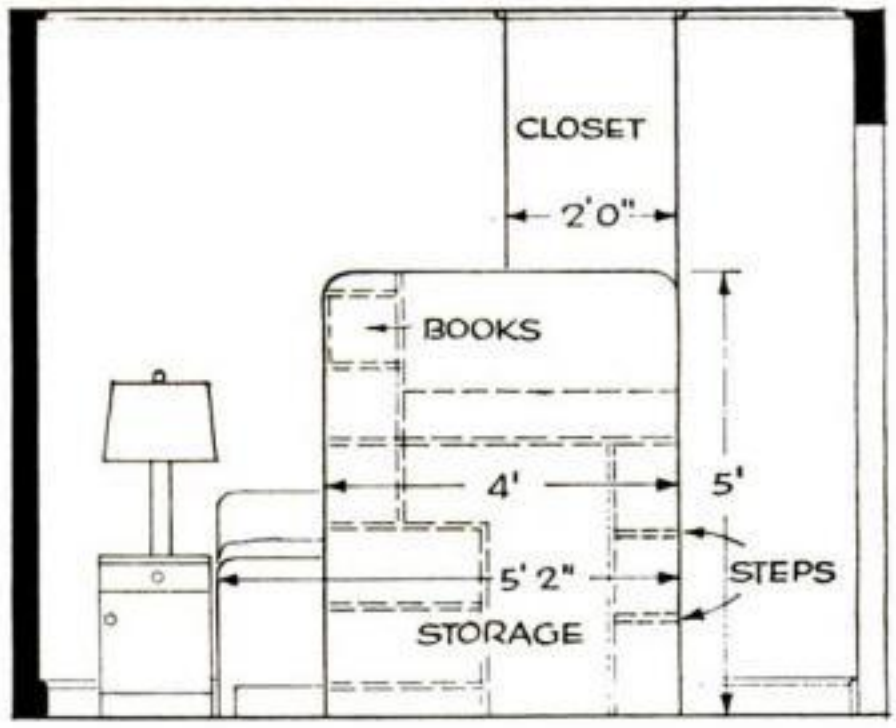
3 Make your dining room a guest room

The least-used space in any house today is the dining room. The plan shows how one dining room was converted into a guest room. Along the kitchen wall, where water and soil pipes were accessible, a lavatory, stall shower, and closet were built. The lavatory has a window but a fan in the outside wall would be adequate.

4 Build an offset bunk bed for a teen-age guest

All youngsters like bunk beds. Here's how you can build your own. The upper bed is built over a standard-size single bed. This provides a place for a son or daughter to have an overnight or weekend guest, as well as extra storage, all within a floor area measuring 5′ 2″ one way and 8′ 10″ the other. Unlike the usual double-deck bed, here two people can face each other and talk. The upper bed in this design is only 3′ 8″ off the floor. So three steps are enough (diagram below at right) to reach the upper level. The new closet, which supports the upper bed, also provides space for a guest's clothing. The upper bed is sized to take a 39″-by-75″ sponge-rubber mattress and steel spring. Build the project from ¾″ veneer plywood. Note that one bookshelf faces toward the upper-bed occupant.





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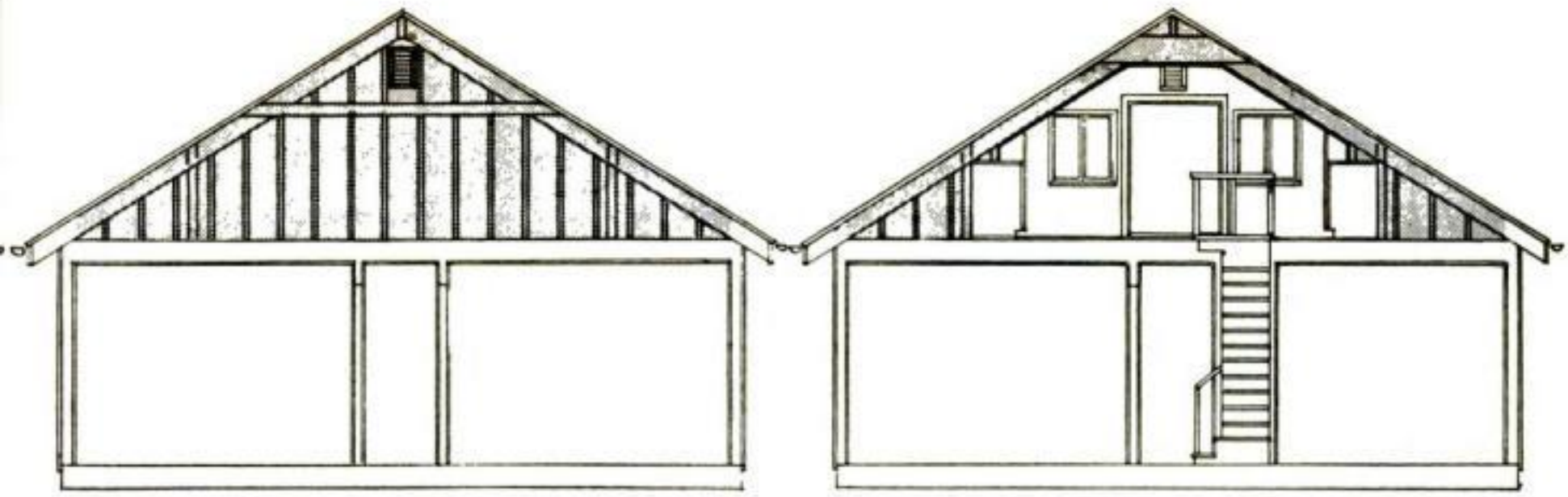
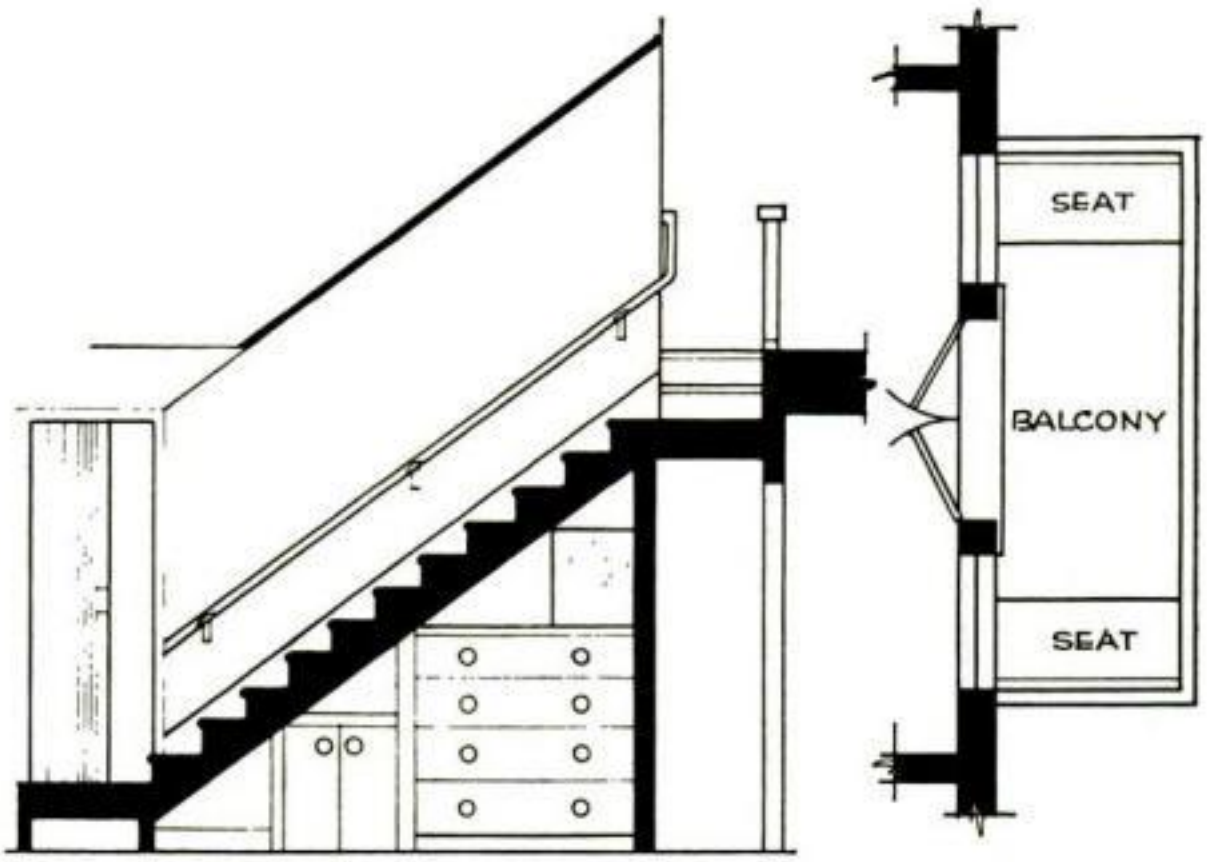
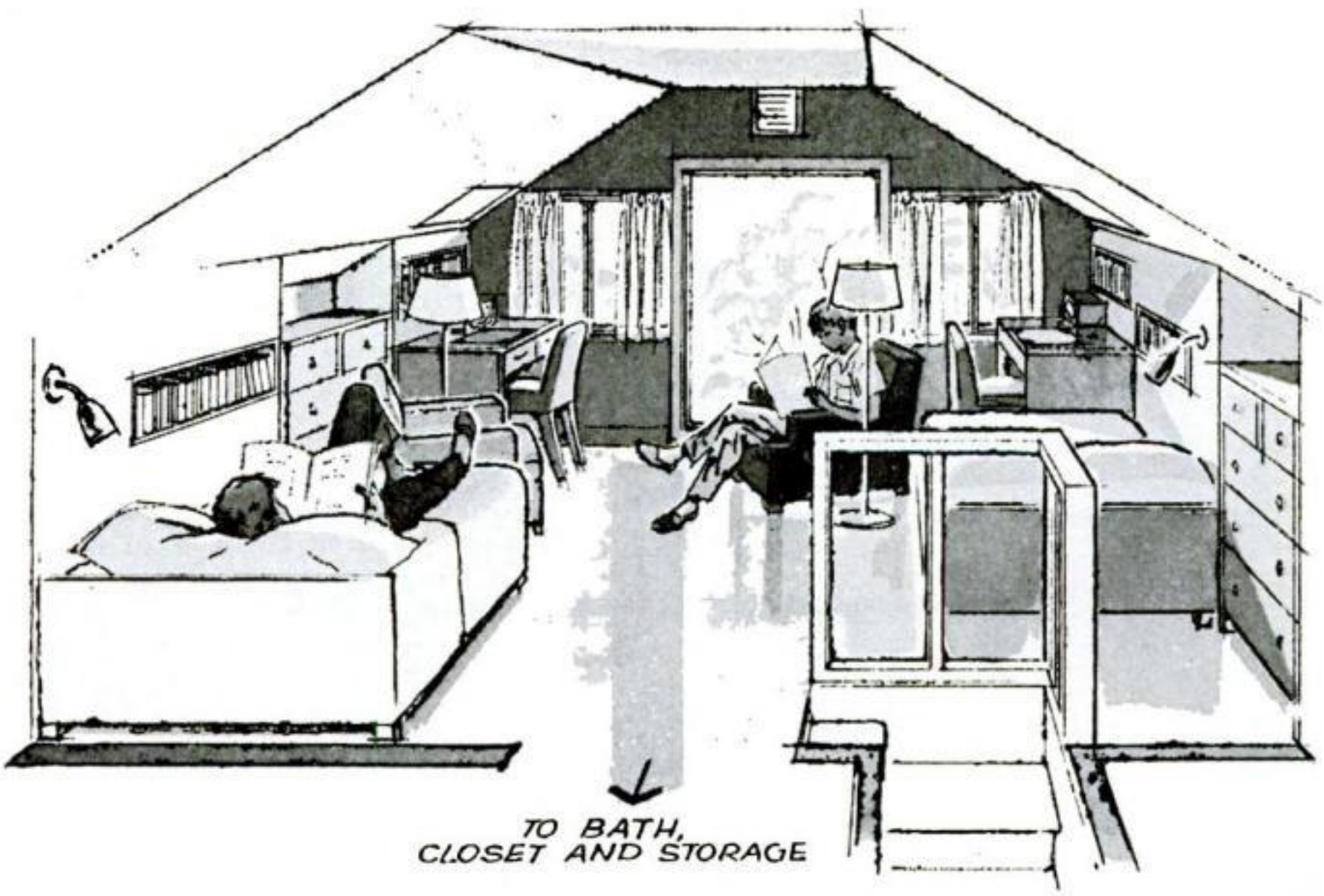


5 How to use a low attic

The collar beams in your attic may be so low that there doesn't seem to be sufficient headspace to add a room. But perhaps there is. Consider replacing the collar beams with short sections of ¾" plywood nailed, as shown above, up under the ridge. If you can thus get 7′ headroom or even an inch or two less, you can build an attic room. You may have to take a 2′ 6″strip out of a room below to build steps to the attic, but storage space can be built under the stairs. Instead of a center picture window at the end of the house, you may prefer to install a door leading to a balcony, as a sketch suggests.





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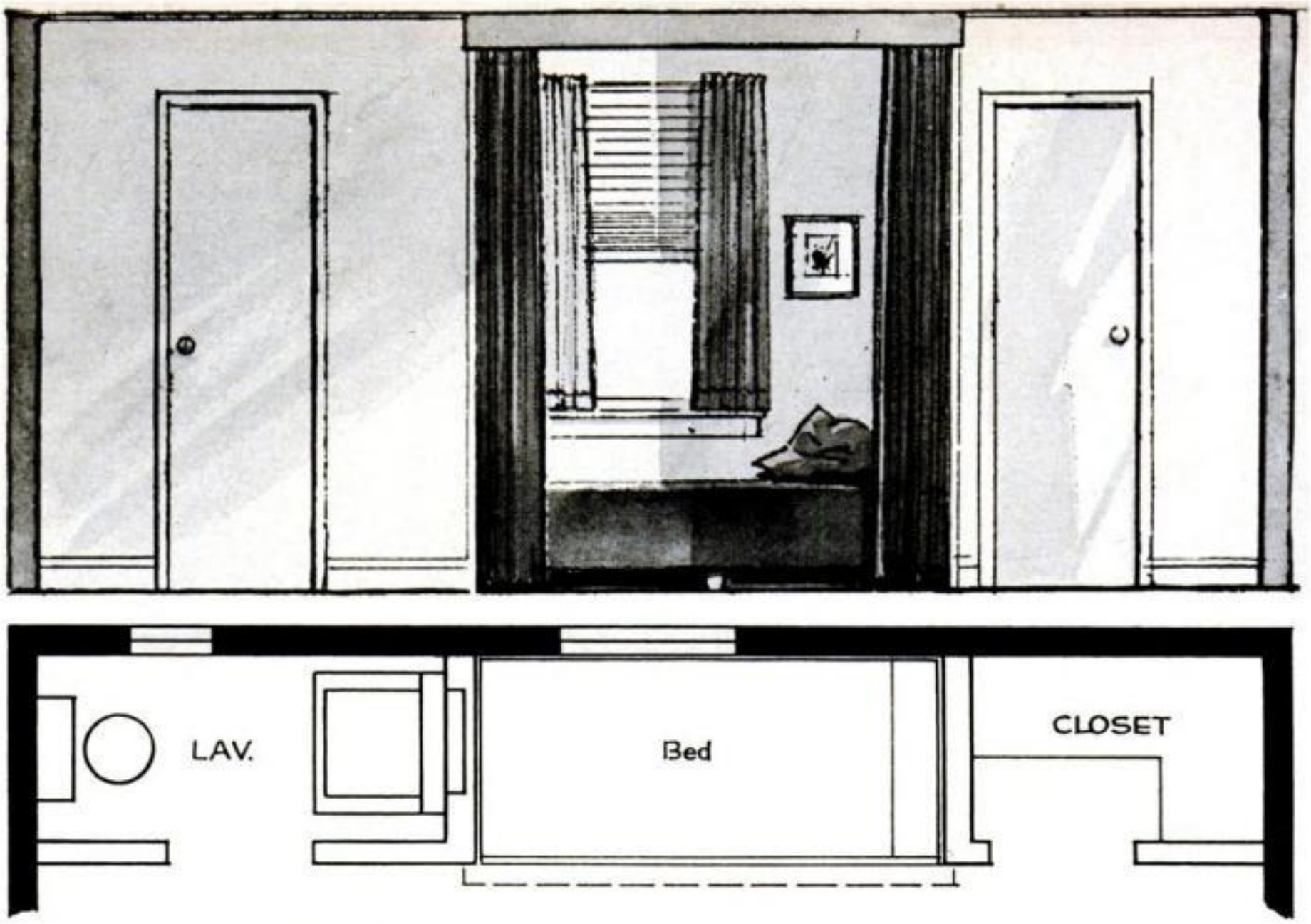
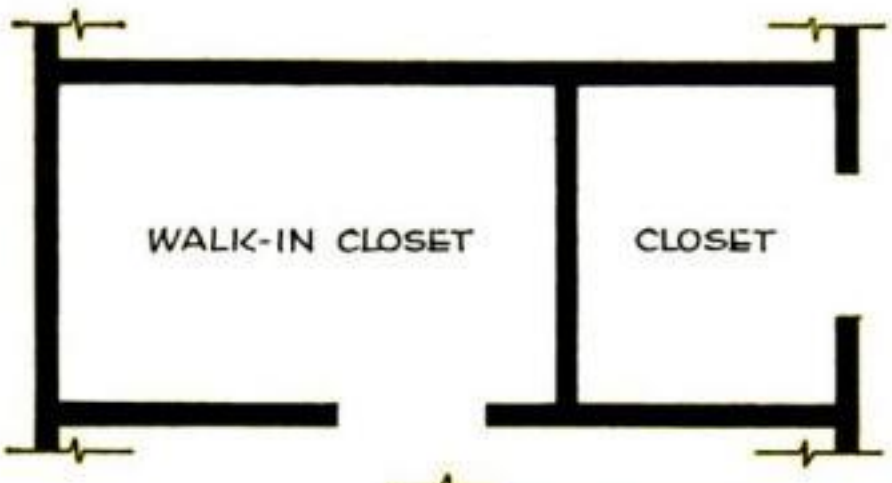


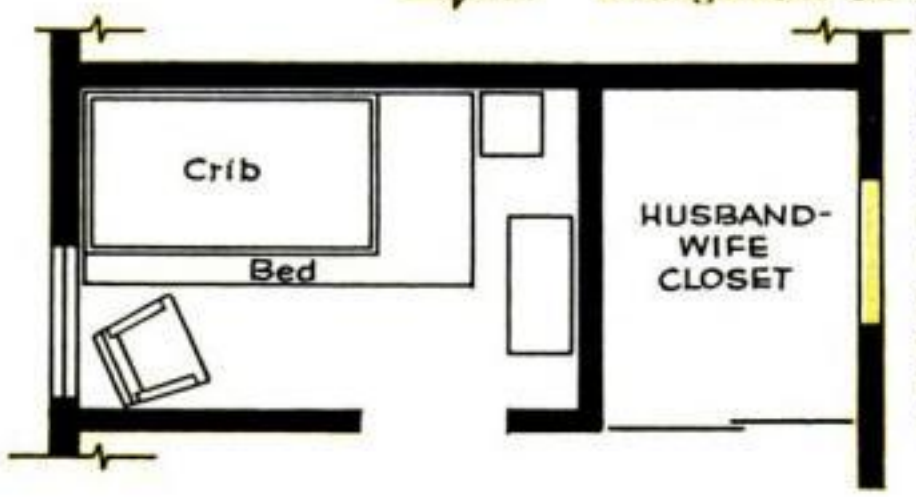
6 Can you spare 3'4" along a family-room wall?

If you can, you have a place for a guest and perhaps an always-useful downstairs lavatory and another closet. The bed, as shown above in the elevation and plan, can be used not only for the unexpected guest, but also for a quiet nap, or as a sofa supported by pillows. For the guest, curtains can be drawn for privacy. The lavatory has a window in it, but an exhaust fan would serve as well for ventilation. The closet at the other end of the bed should be big enough to occupy the rest of the width of the family room. Big or little, the closet will be useful not only for the guest but also for a variety of other purposes. Both closet and lavatory doors should be 2' wide. If you already have a downstairs lavatory, or if water and soil pipes are not readily accessible, build in a chest of drawers in place of the lavatory. Instead of a single bed, you can use a sofa that converts when needed to a double bed.



7 Your brand-new permanent guest will need a room

The walk-in closet is a favorite talking point of realtors today. Many are as big as small rooms. But the center aisle is lost space; as much as a third of these walk-ins is unusable. The plan at left is an actual arrangement off a master bedroom in a development house. It's big enough for use as a nursery. The lower plan shows how it was done in one case. Just add a window. The walk-in closet off the hall became a husband-wife closet, and the larger closet, now with a window, became a new baby's room.



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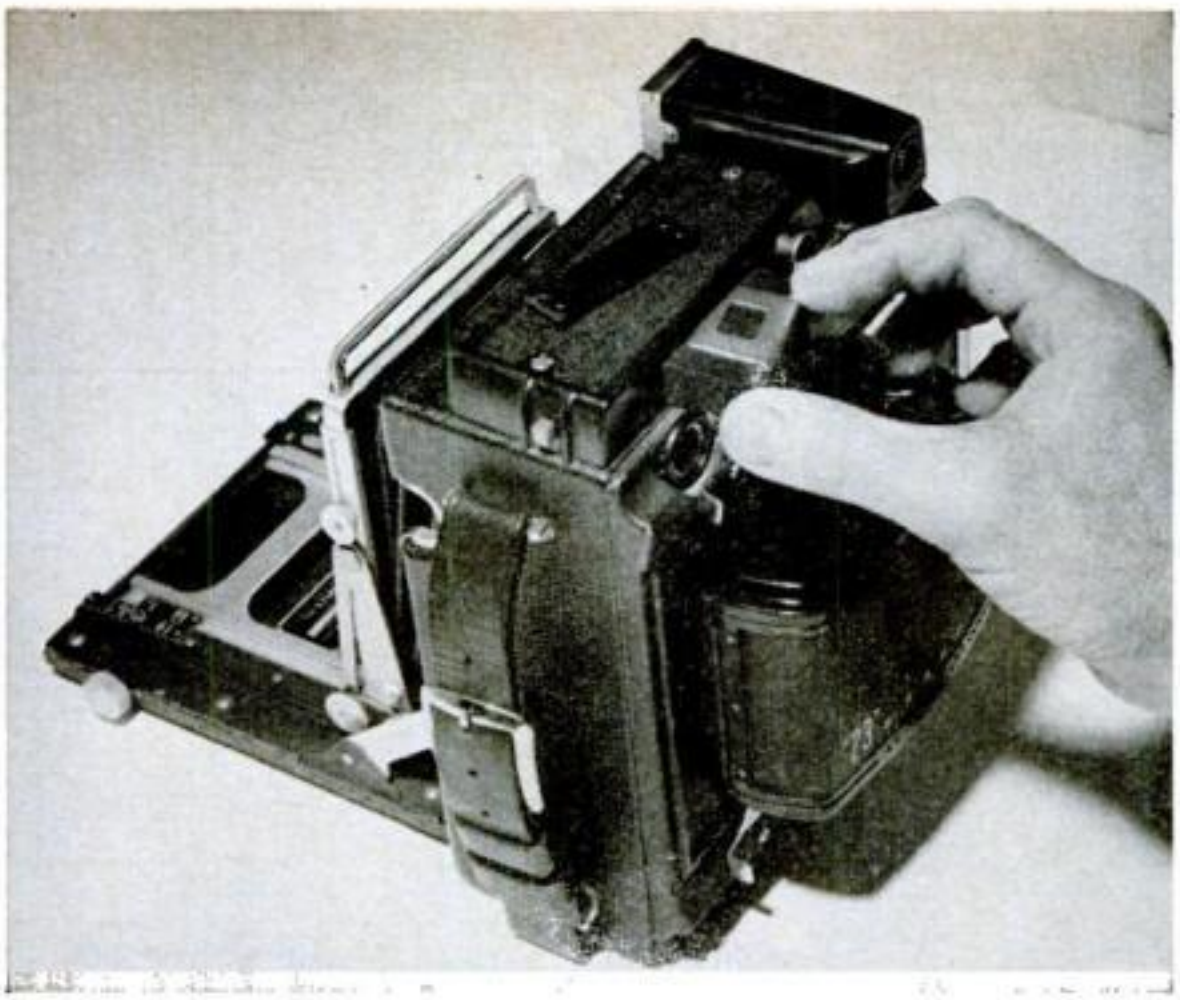
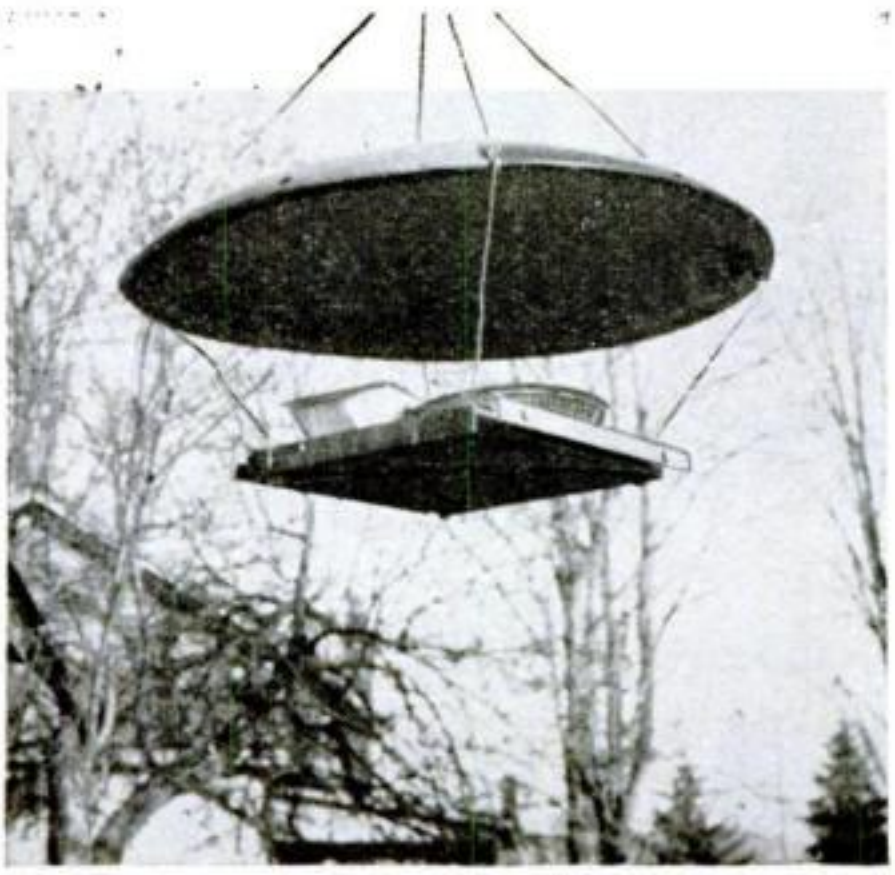
Short Cuts and Tips FROM PS READERS



Spare camera mask hides in the battery holder

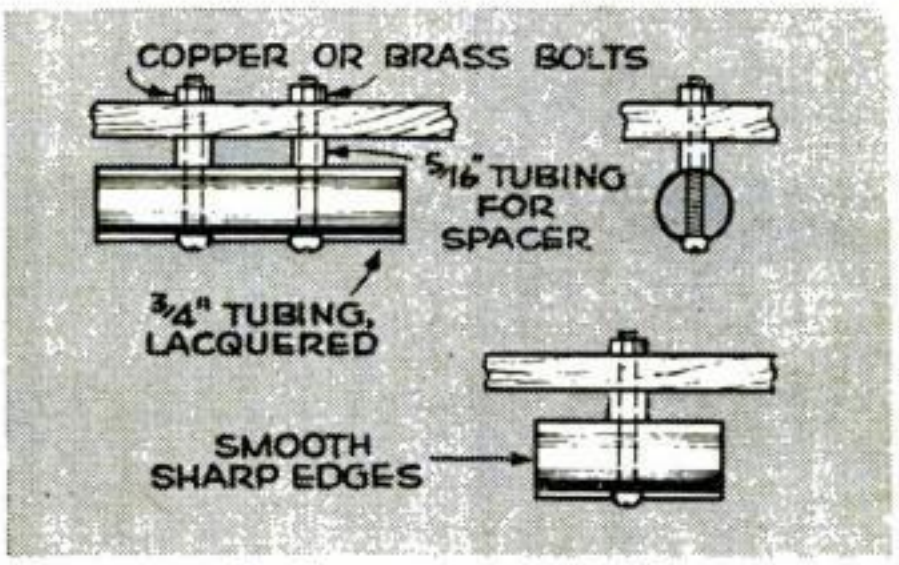
Using a roll-film pack on a Graphic calls for a special viewfinder mask. I was always mislaying mine until I hit on this: I removed the wood block that substitutes for a battery and notched it so the mask fits into it. Since I don't use a battery, the block and mask go along with me in its place.—*Nathan Kuykendall, San Francisco.*

▶▶▶ Epoxy paints are expensive, and you can't afford to waste them. When I discovered I had mixed more than I could use, I put about half a quart into the freezer in hope of slowing down the chemical reaction of the two ingredients. Two weeks later, it was just as fresh as when I mixed it.—*A. Weber, Edmonton, Canada.*



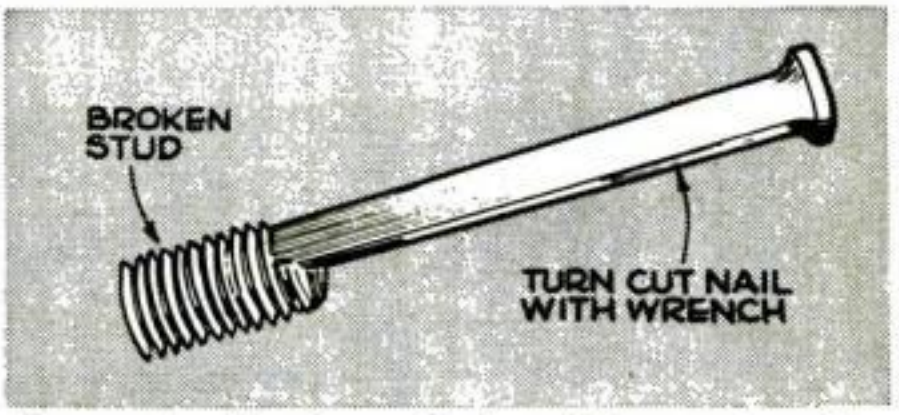
"Flying-saucer" feeder was a sled

When our youngster outgrew his saucer sled, we turned it into an unusual and attractive bird feeder. Turned upside down, the big aluminum disk forms a canopy that keeps both the birds and their food dry even in a driving rain. The food dishes rest on a small board slung on wires below the disk.—*Mark Hyde, Homer, N. Y.*



Drawer pulls from copper tubing

Short lengths of copper tubing can make handsome drawer pulls with a distinctive look. Cut spacer collars from a smaller-size tubing to go between the handle and the drawer front. Use one bolt to hold small knob-size pulls, two for longer handles.—*Ray Eaton, Bangor, Me.*



Removing broken studs with a cut nail

Broken-off studs can be removed this way. Drill a hole in the end and drive in a square-sided cut nail. The nail jams itself in the hole and can be turned easily with a wrench or pliers to back out the stud.—*Cliff Freeman, Birchwood, Wis.*

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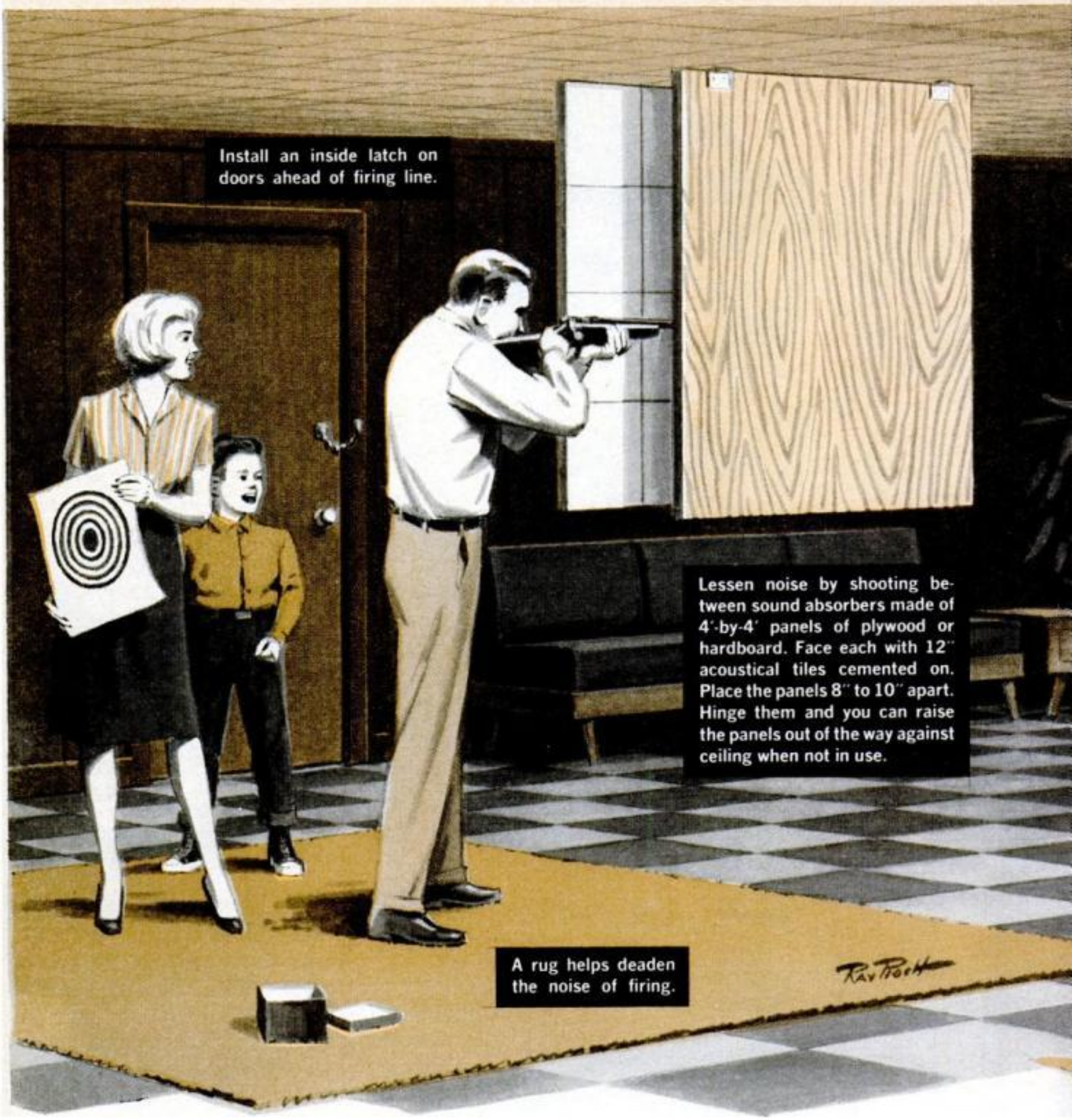
Install an inside latch on doors ahead of firing line.
Lessen noise by shooting between sound absorbers made of 4'-by-4' panels of plywood or hardboard. Face each with 12" acoustical tiles cemented on. Place the panels 8" to 10" apart. Hinge them and you can raise the panels out of the way against ceiling when not in use.
A rug helps deaden the noise of firing.

Setting Up a Basement Shooting Range

By Paul Wahl

TARGET shooting with rifle or handgun has always been a popular sport. But as more and more open fields and woods turn into suburban areas, it gets harder to find a place to shoot. For many, the solution lies right downstairs—in a basement target range.

You and other members of your family can win awards on such a range. The Na-

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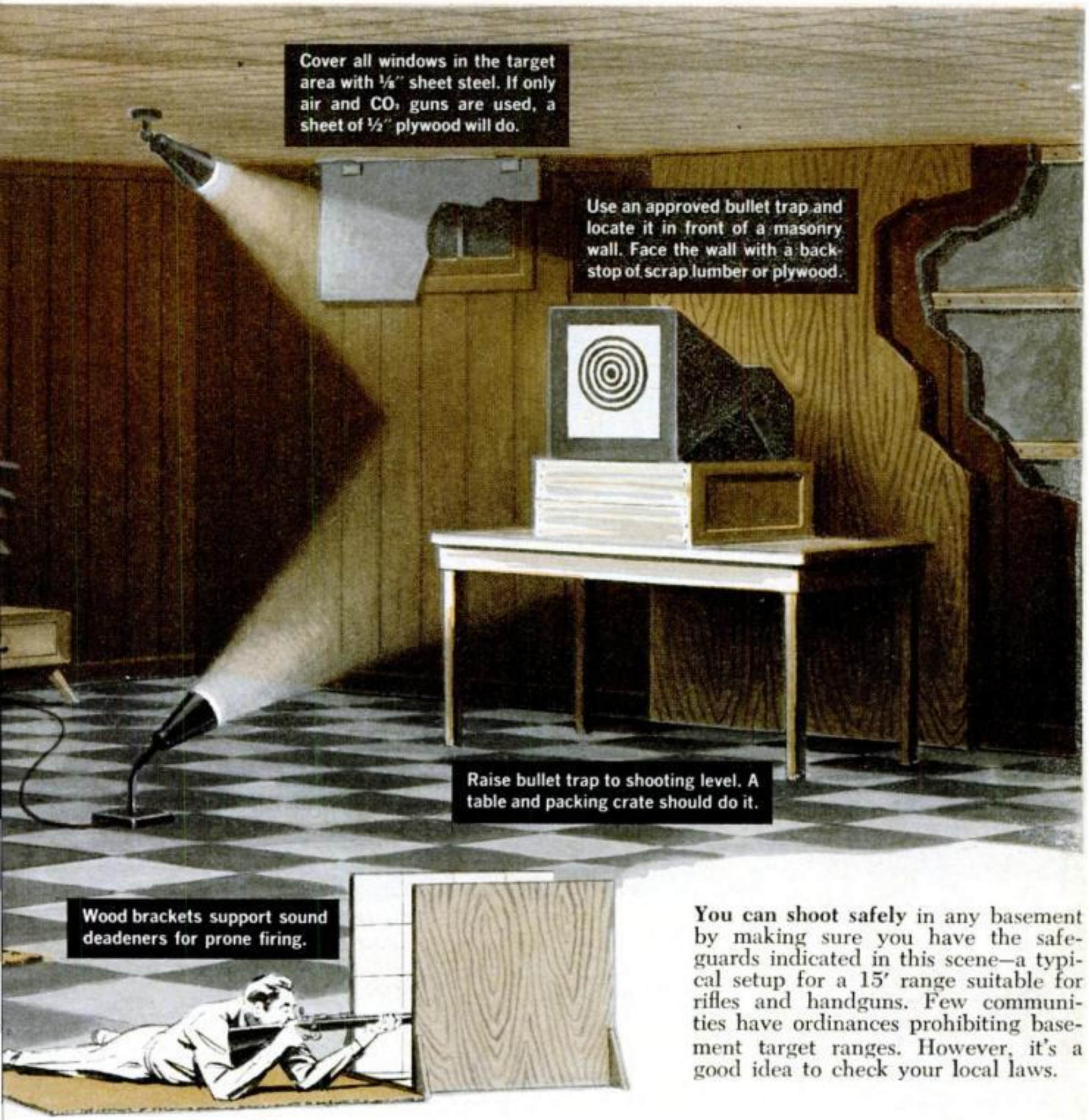
Cover all windows in the target area with ⅛" sheet steel. If only air and CO_2 guns are used, a sheet of ½" plywood will do.
Use an approved bullet trap and locate it in front of a masonry wall. Face the wall with a backstop of scrap lumber or plywood.
Raise bullet trap to shooting level. A table and packing crate should do it.
Wood brackets support sound deadeners for prone firing.

You can shoot safely in any basement by making sure you have the safeguards indicated in this scene—a typical setup for a 15′ range suitable for rifles and handguns. Few communities have ordinances prohibiting basement target ranges. However, it's a good idea to check your local laws.

tional Rifle Association of America has a special program for air and CO_2 guns at 15′ and 25′ ranges. Both junior and adult shooters can earn rifle and pistol qualification awards, even compete in NRA-sponsored postal matches—competitions by mail, in which you engage without leaving home. You can get details from the association (1600 Rhode Island Ave. N.W., Washington, D.C. 20036).

Choose your weapon. Although .22 rimfire rifles and handguns probably will remain most popular with dyed-in-the-wool shooters, pneumatic and CO_2 gas guns now have come into their own for indoor target shooting. Today's pellet guns are relatively low in price and very cheap to shoot. They are accurate at 25′, give good practice.

If your revolver is a .38 or a .44 and dry practice is beginning to pall, even this ordinarily loud-mouthed handgun can be used for basement target shooting. All you need is a supply of Speer Target 38s or 44s (Walmax Tru-Blue 38s are similar) and primers. These plastic bullets and cartridge cases are re-usable up to 20 times. The propellant is a large pistol primer, and the report is like that of a .22 short fired in a handgun. Accuracy is adequate for target practice at 15′ to 25′.

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Four bullet traps you can buy—and how they work

Steel plates stop bullets in these traps. Specifications for each one shown: Detroit Standard Model, 12″ wide, 14″ high, 16½″ deep (front to back); $17; Detroit Bullet Trap Co., 1436 E. Davis St., Arlington Heights, Ill. Gunslick No. 200, 11″ wide, 12″ high, 9″ deep; $17.95; Outers Labs., Onalaska, Wis. Sheridan Model 38, 12½″ wide, 18″

The space you need. Standard short ranges are 15′ and 25′ (from muzzle to target). You'll need another 4½′ (8′ for prone rifle shooting) to the rear of the firing line and 12″ to 30″ behind the target for the bullet trap. If you can't get enough distance parallel to a wall, try a diagonal, corner-to-corner layout.

The bang-bang! The report of a standard-velocity .22 long-rifle cartridges, in a rifle, isn't loud enough to disturb anyone in a neighboring house. In a handgun, however, this round produces a loud report and you may get complaints.

No tools are needed to reload new plastic practice rounds for revolvers. Finger pressure seats bullets and the large pistol primers that propel them. Shown here are Target 38s and 44s developed by Speer Products Co., Lewiston, Idaho. They contain no powder.

Less noisy and sufficiently accurate for short-range target shooting, .22 shorts (standard velocity), .22 CB caps, and .22 BB caps may be fired in most rifles and handguns chambered for the .22 long rifle. When these shorter cartridges are used, chambers must be cleaned thoroughly after each session to avoid build-up of residue.

The noise of firing may be reduced by holding the weapon between a pair of sound-absorbing boards. The effect is to lower the pitch of the report, making it less disagreeable. These boards are easily constructed by cementing acoustical tile to two panels of plywood as shown in the opening illustration.

Bullet traps. An effective bullet stop for pellets and .22 rimfires can be made in a few minutes from no-cost materials: a corrugated box and a stack of old magazines. Its life, however, may be less than 1,000 shots.

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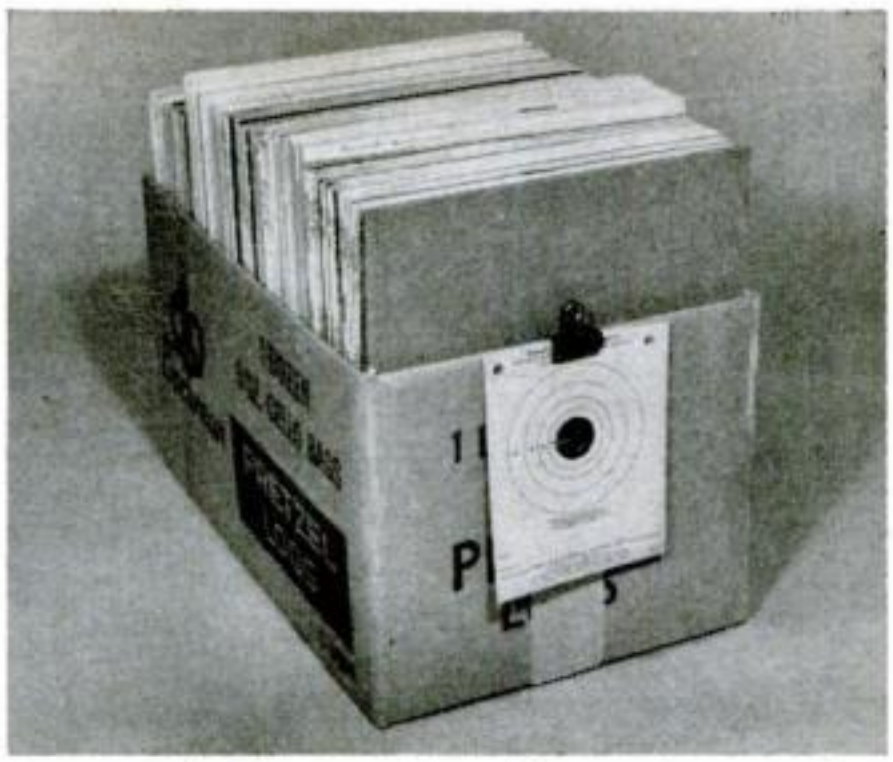
high, 11" deep; $26.50; Sheridan Products, 1234 13th St., Racine, Wis. X-Ring 12" Table Model, 12" wide, 12" high, 27" deep; $24; X-Ring Products, Onalaska, Wis.



A no-cost bullet stop for pellets and .22 rimfires can be quickly assembled from a 24" to 30" stack of large magazines and a corrugated box that will hold them tightly packed and standing on end. A .22 rimfire standard-velocity bullet will go about 10" into the magazines. You can fire several hundred shots before replacement is necessary. Secure the target to the bullet stop with a spring clip, as shown. Position the stop so that the bullets won't strike at an angle.

If your range will be used fairly often, get a good commercial bullet trap—these are not expensive and last virtually forever. Traps intended for use with firearms are also well suited to catching lead pellets shot from air and CO_2 guns.

To catch plastic bullets without damage, use a corrugated paper carton with a piece of rug or tarpaulin suspended from a dowel in the middle of the box. This type of bullet stop may be used with BB guns, too.

In selecting a trap, make sure that the front opening is large enough so that even a beginner can keep all shots within the mouth. For 15′ and 25′ shooting, the opening should be at least 10" square.

Safety measures. To stop any stray bullet that might miss the bullet trap, the wall behind it should be masonry and faced with a 4′-square backstop of scrap lumber or plywood. Windows in the target area or along the line of fire should be covered with ⅛" steel plates (½" plywood will do if only air and CO_2 guns are used); these can be hinged to fold out of the way when the range is not in use. Doors giving access to the area in front of the firing line must be locked from the range side.

The most important safety measure is strict enforcement of the rules of safe gun handling, especially this one: All weapons must be kept unloaded, with breech open, until the shooter is on the firing line with his gun pointed toward the target.

Lighting the target. Use a 150-watt floodlamp in a swiveling ceiling fixture about 10′ in front of the target, or place a gooseneck desk lamp with a 100-watt bulb a few feet in front and to the side of the bullet trap.

The targets. Official NRA targets for the 25′ range are: A-18 single-bull and A-19 five-bull rifle, B-1 slow fire and B-10 timed- and rapid-fire pistol. These targets can also be used at 15′, and while you may find the other 25′ targets rather easy at the shorter distance, the tough B-1 pistol target should prove sufficiently challenging to all but the most expert handgunners, even at five yards.

Plinkers, to whom paper-target punching seems dull, can make their own satisfyingly bustable targets from ordinary mothballs. To provide a "stem" for hanging, simply heat the end of a 6" length of stiff wire in a gas flame and plunge it into the mothball, which melts at the puncture, then cools and hardens, gripping the wire. Hit squarely, the mothball "explodes." ■ ■

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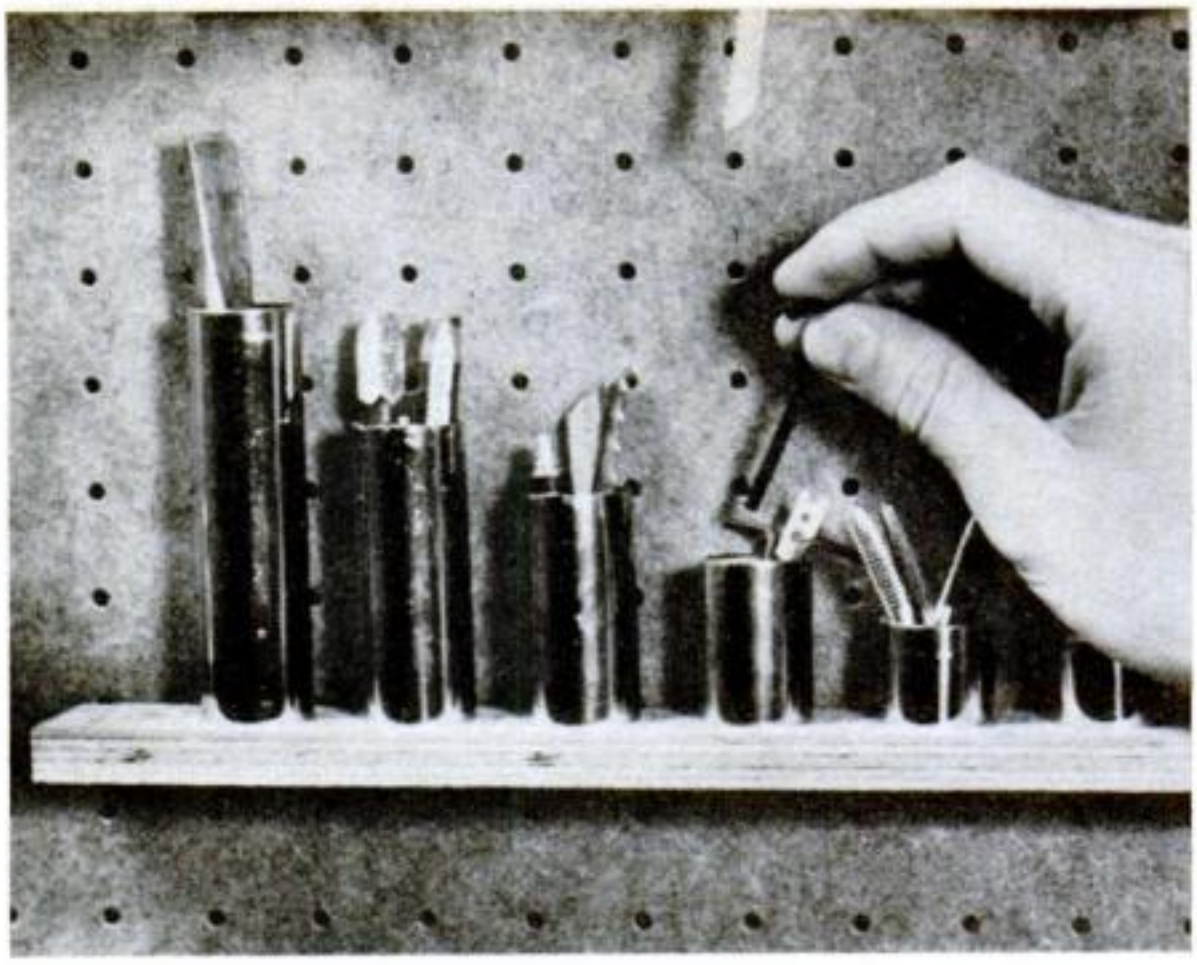
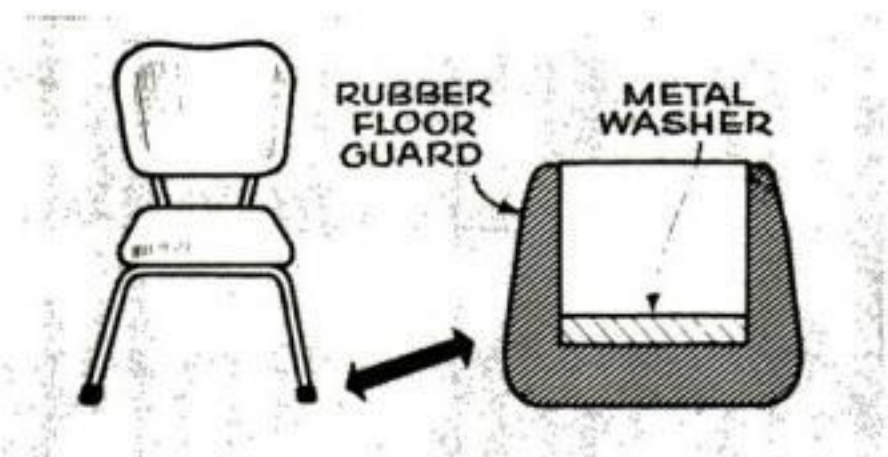
Short Cuts and Tips FROM PS READERS

Graduated tool rack from sections of metal tubing

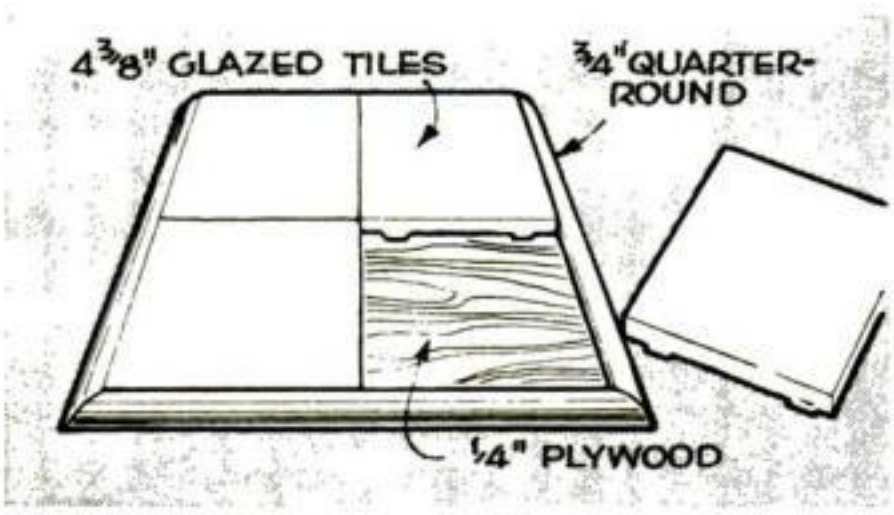
It's hard to store small items on a tool board, because they won't fit in the usual clips and holders. Sections of metal tubing cut to graduated lengths make handy holders for many small tools of different sizes. The tubes are press-fitted into holes drilled part way through a wood base.—*Duane E. Beals, Blue Mound, Ill.*





How to protect a floor protector

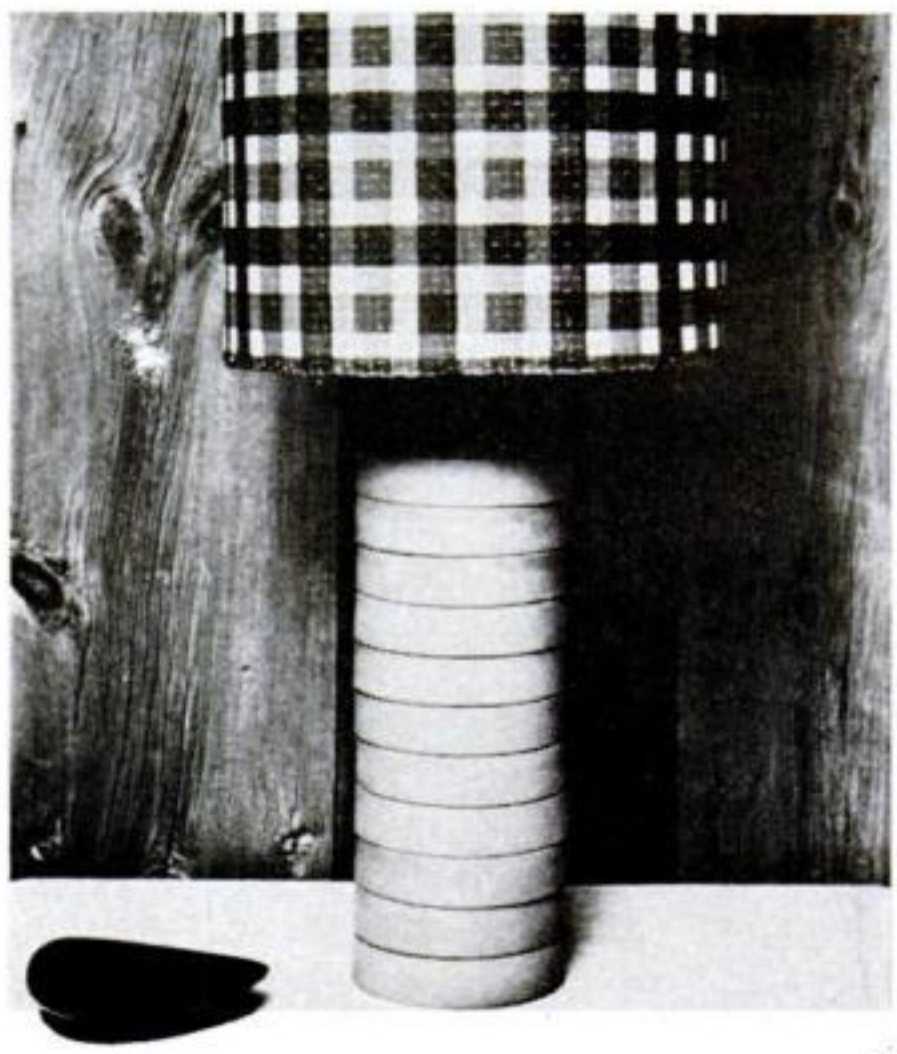
The sharp edges on tubular-metal furniture legs will cut right through rubber floor guards. If you can't get caps to fit the tubing, you can stop the cutting by inserting washers in the guards.—*Charles W. Gaston, Linthicum Heights, Md.*



Hot-dish tiles can stay home or roam

This big table protector turns into four smaller ones when several are needed at one time. It's made up of four 4⅜" glazed ceramic tiles set into a wood frame. The tiles can be left in the frame or removed for individual use. Four thin wood pads are glued under each tile for insulation.—*H. A. Urban, Bradenton, Fla.*

▶▶▶ An icepick is a handy tool when you are mounting hinges. The sharp point will spot the screw exactly in the center of the hinge hole. In soft woods, you can make a hole big enough actually to start the screws. —*Ralph S. Wilkes, Keuka Park, N.Y.*



A potted lamp—from flowerpots

A stack of red clay flowerpots turned upside down makes a rustic-looking lamp base for your den or playroom. The drain holes in the pots make it easy to run standard brass lamp tubing up through the stack to carry the wire. At the top, add a socket, lamp harp, and shade, and you have an unusual lamp.—*T. P. Mason, NYC.*

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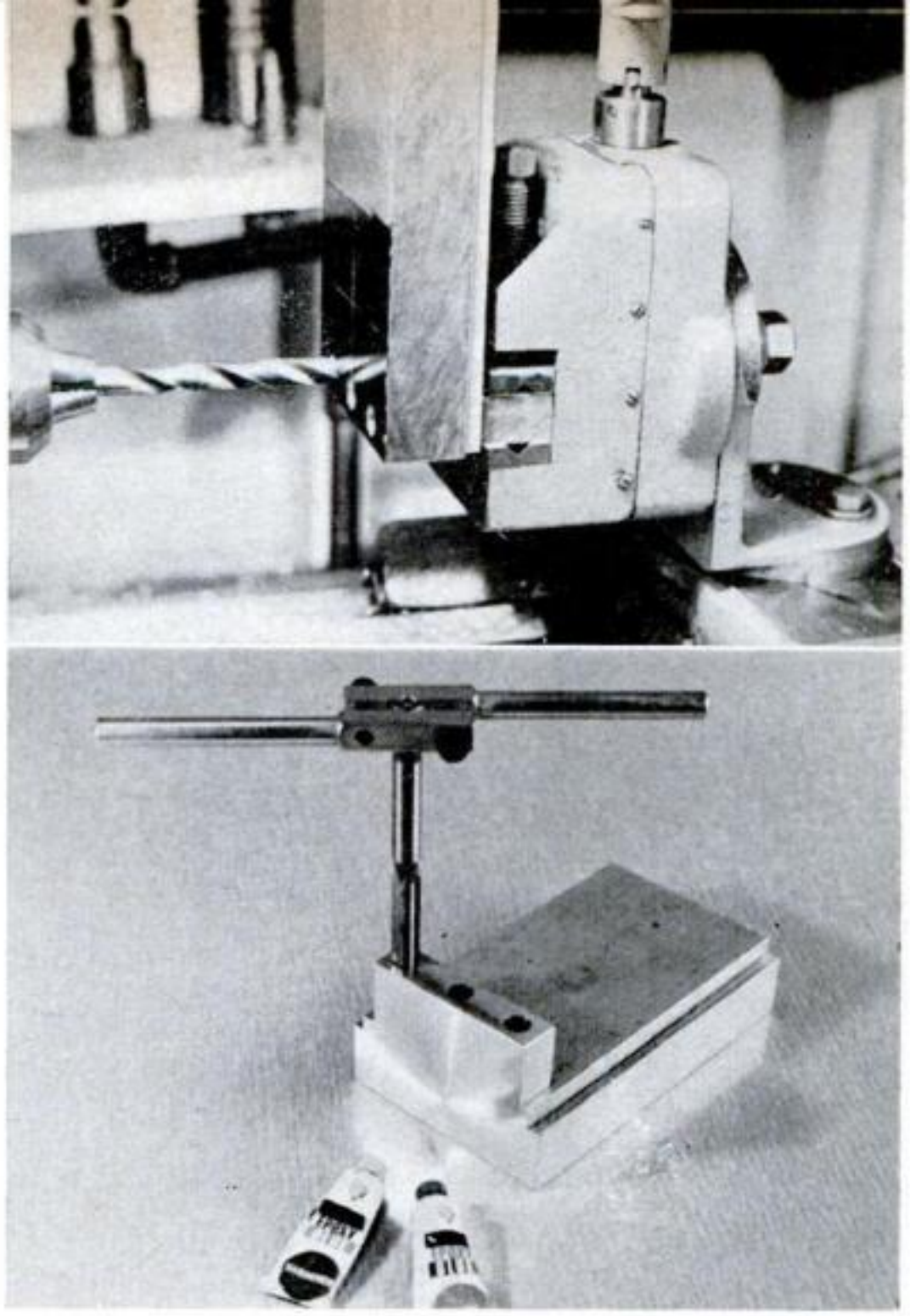
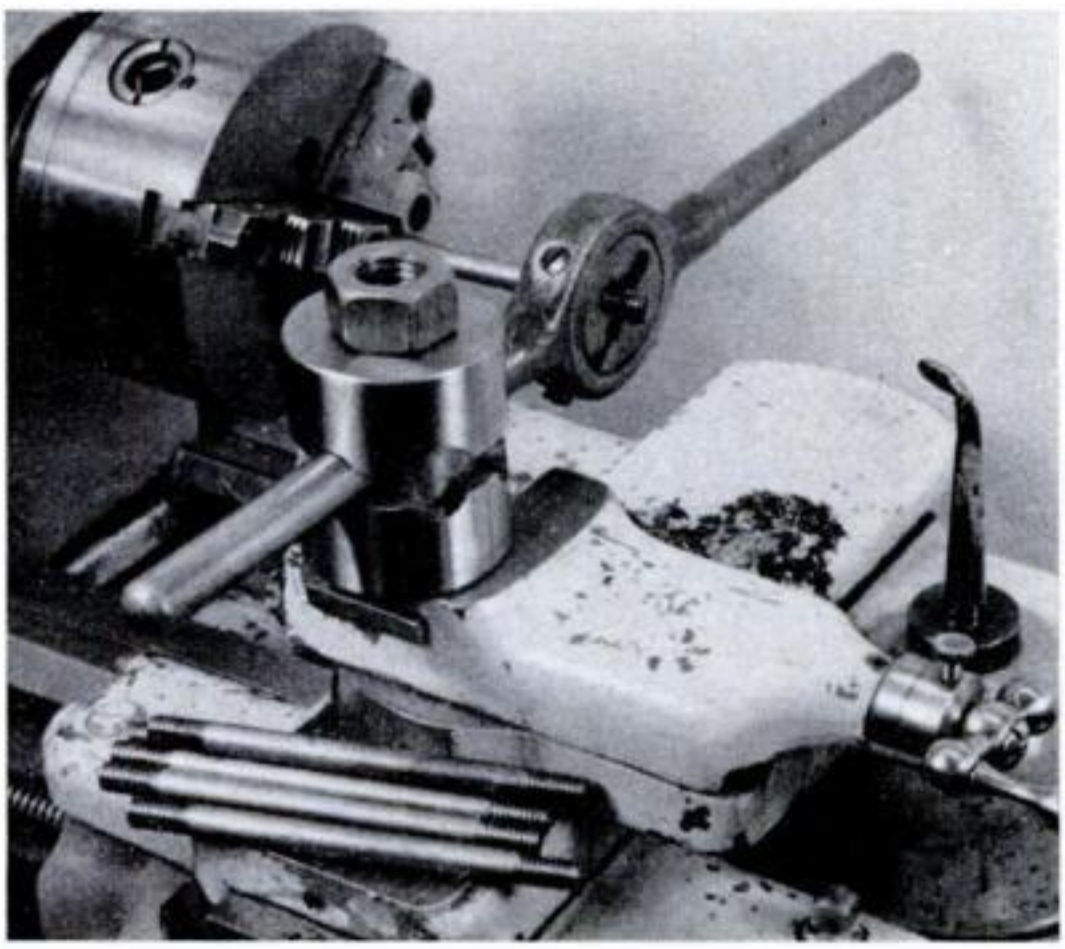
PS METALWORKING

Short Cuts and Tips for Machine-Shop Workers



Epoxy serves as a "clamp"

Epoxy is useful in a machine shop when clamping is difficult or impossible. Here's an example—three glued aluminum pieces being drilled (upper right) and reamed (right). Clean the metal well. Clamp parts overnight while the glue sets. Use only light machining cuts. Separate the parts with heat.—*T. L. Turner, Irving, Tex.*



Quick and easy way to cut threads

Chuck studs, bolts, or pipe in a lathe, mount your die stock in a block-type boring-tool holder seated on the compound, as shown above, and you're set up for a smooth production run of thread cutting. You can use either hand or power feed to run the die. For power feed, set the lathe's quick-change box to the thread pitch.—*H. J. Gerber, Menomonie, Wis.*

Extra jaws for a bench vise

The auxiliary jaws shown below will enable you to hold small, round objects in a bench vise. Two 3/16″ drill-rod guide pins fit precisely in reamed holes, as do two compression springs. The jaws were clamped together and five holes of varying size drilled along the joint. About .005″ was machined from each inner edge to make the holes slightly oval.—*C. Gibbons, Greenwood, Canada.*

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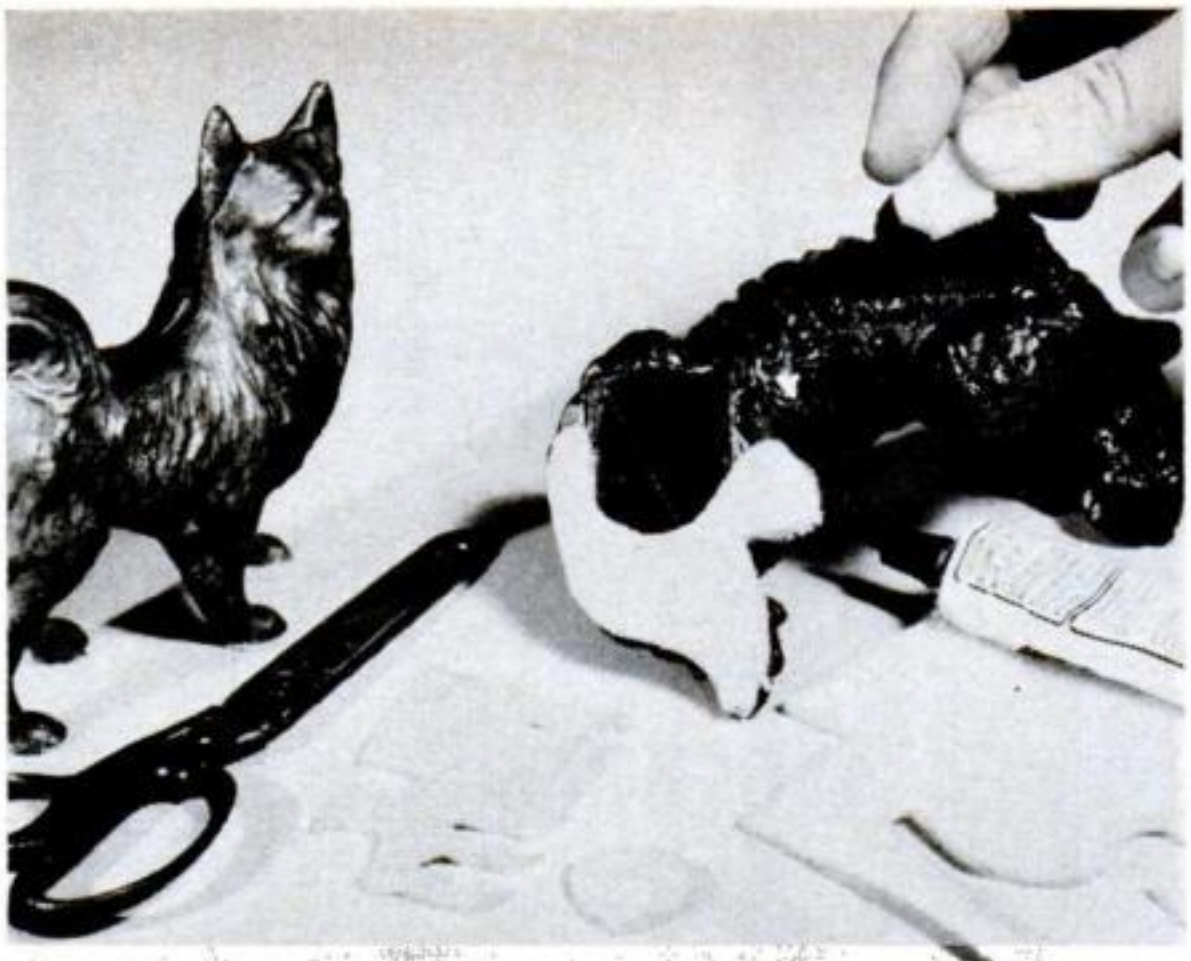
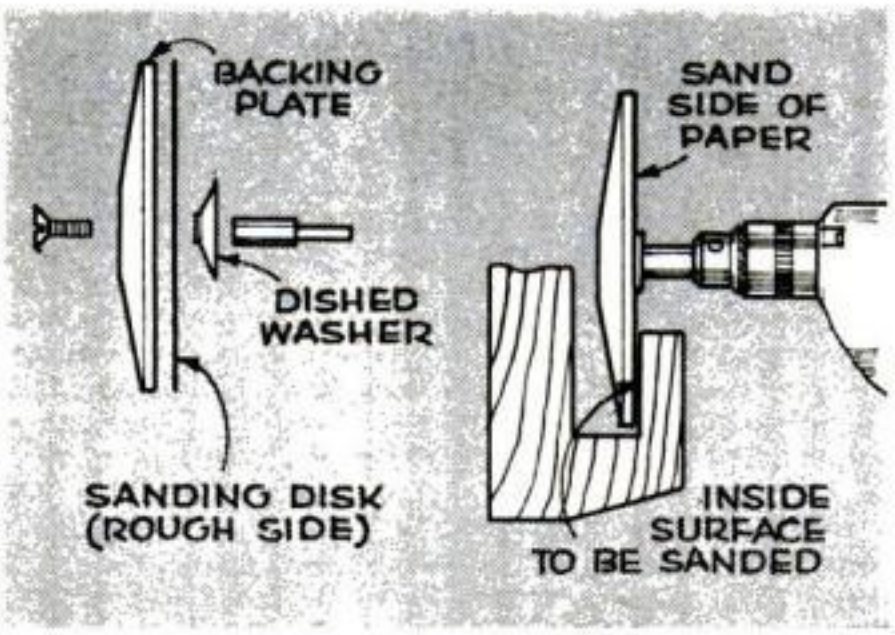
Short Cuts and Tips FROM PS READERS

Salvage packing plastic for nonscratch pads

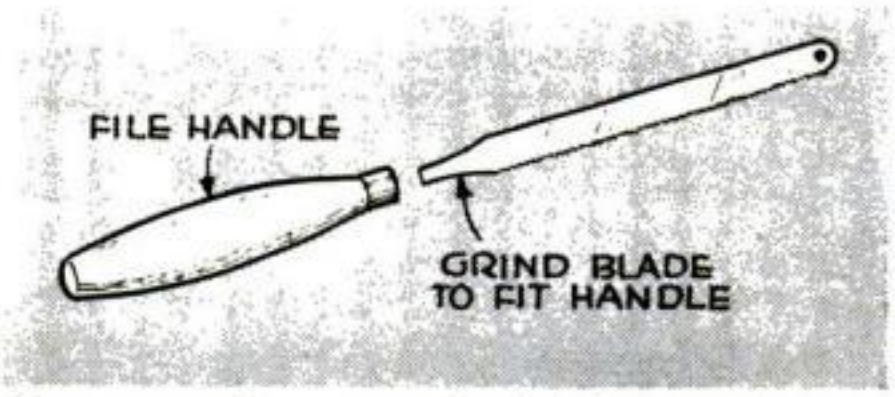
Neat pads for lamps and various ornaments can be cut from thin foam plastic used for packing photographic and other delicate merchandise. Cut the pads to any desired shape with scissors. Glue them on with household cement or white glue. The soft foam also keeps an object from slipping.—*S. L. Walton, White Plains, N.Y.*





A useful sanding trick to remember

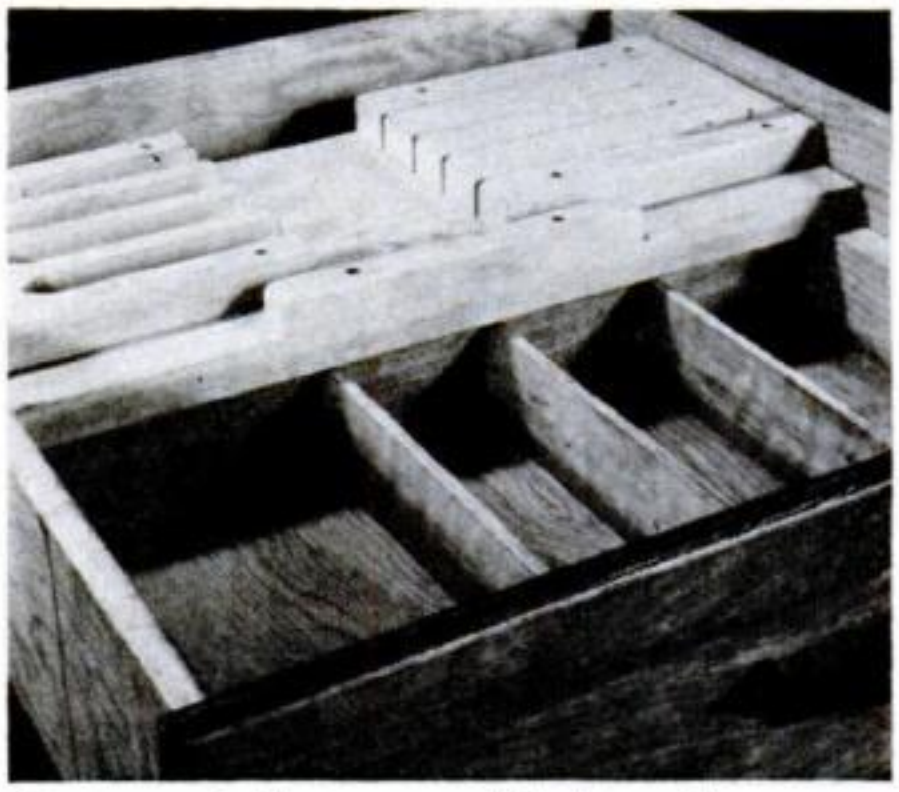
I've found that reversing a sanding disk in an electric drill, as shown above, will often enable you to sand areas where the conventional grinder or sander can't reach. The sketch shows a typical situation. —*Charles Lobaugh, Portland, Ore.*



How to make a saw for hobby work

Fine saw cuts are sometimes required in hobby work. A 4″ to 5″ length of broken hacksaw blade, ground as shown and inserted in a file handle, is convenient for this work. Replace the blade when it becomes dull.—*E. Wieczorek, Chicago.*

▶▶▶Cement nails make fine center punches for indenting the spot you want to drill in metal. Resharpening is easy on an emery wheel. You can buy quite a few for a quarter. If you keep a number on hand, you can use a new punch for each hole in an extensive drilling job and grind them all later.—*R. Carabin, Bandera, Tex.*



One way to improve a kitchen drawer

A drawer used to store flatware doesn't have to be more than 2″ or 3″ deep, yet you'll find that most are as much as 6″. The photo shows how to utilize all the space in such a drawer—limit the height of the bottom dividers and install a movable tray on top of them. The one shown was designed for safe storage of sharp kitchen knives. It slides front to back, or lifts out. —*R. J. De Cristoforo, Los Altos Hills, Calif.*

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SHOP TALK

By Sheldon M. Gallager

Want to do your own galvanizing? You can!

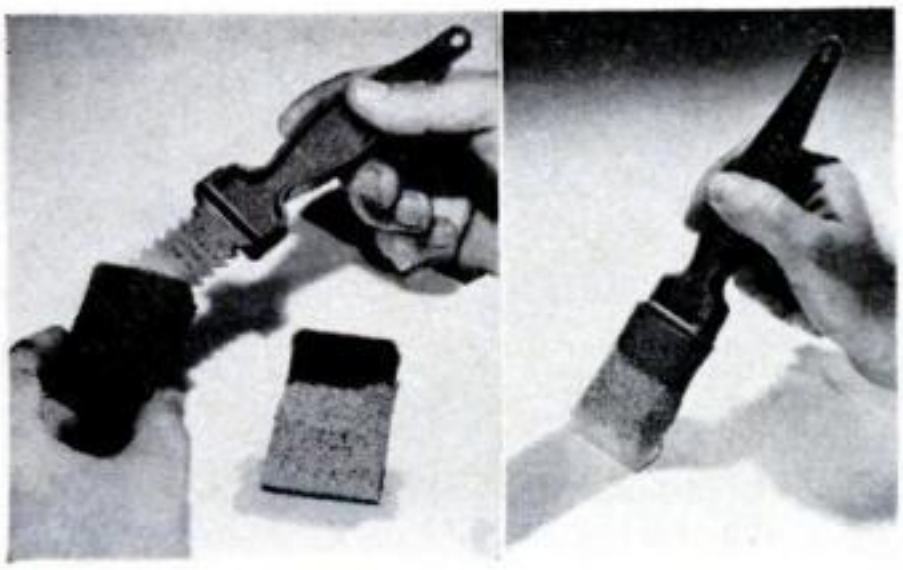
Ran across an interesting item the other day that was news to me, although I discovered it's been around for years. Thought I'd pass it along. It's Galv-Weld, a special solder-like alloy in rod form that lets you zinc-coat metal parts yourself to rustproof them. It's handy for repairing scratches in galvanized articles where rust starts or for coating fittings and hardware that you can't buy galvanized. No flux is needed. You just heat the work to about 600 degrees (possible with a small gas torch) and rub on the rod as at left, until the coating flows. Wire-brushing it while molten helps to distribute it evenly. It can then be smoothed with a coarse cloth. A kit containing two 10" rods and instructions sells for $1 from the W. J. Ruscoe Co., 475-485 Kenmore Blvd., Akron, Ohio.

Now: Shop lubricants in handy hang-up dispensers

Small tubes of shop lubricants have a way of getting mislaid just when you want them most. Here's a clever idea aimed at solving the problem. It's a set of assorted shop oils in hook-topped tubes that hang on a toolboard, as shown at left, for easy access and safekeeping. The tubes come in five types: motor and machine oil, rust-cutting oil, red penetrating oil, graphite penetrating oil, and neat's-foot waterproofing oil. They sell for about 30 cents each. The Boyer Chemical Co., 1611 Church St., Evanston, Ill., is marketing them.

A dream come true: Disposable paintbrushes

We've all been tempted by the urge to toss away a messy, gooked-up paintbrush rather than bother to clean it. Well, here's a brush designed for just that. Instead of bristles, it has interchangeable heads of soft plastic foam that fit on a handle.



When you've finished with a paint job or want to change colors, you pull off the gunked head and slip on a clean new one. Besides being disposable, the plastic foam is said to eliminate brush streaks and bristle shedding. It paints a smooth, straight line, making it especially good for sash and trim work. The 1½" size shown at left sells for 79 cents with three heads. A 2½" size sells for 98 cents. Extra heads cost 15 to 20 cents each. Kimball-Schmidt, Inc., San Rafael, Calif., is the maker.

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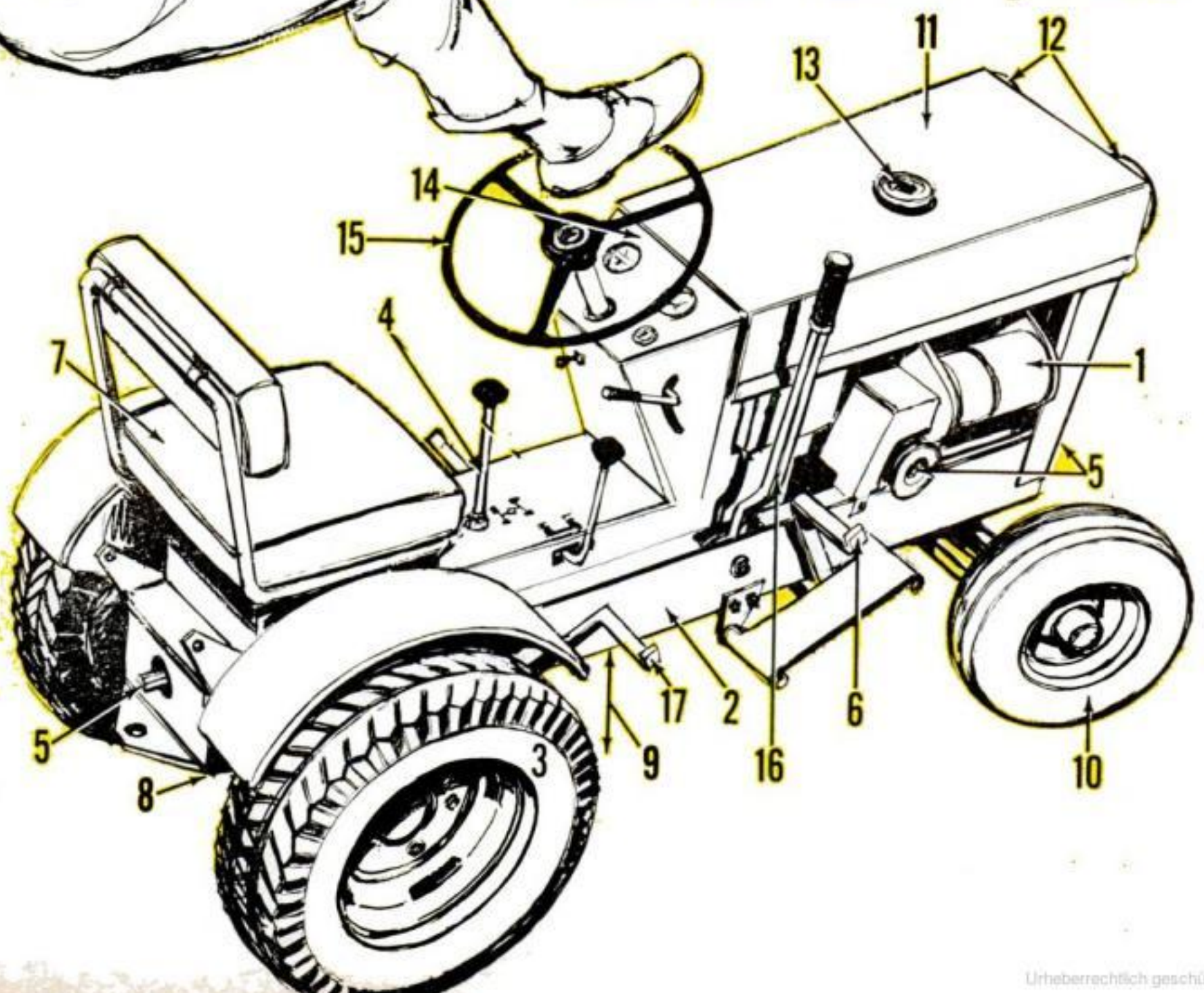
Doing your yard chores can be real fun! Here are tips from the experts on—

Shopping for a

Check these points



By Jackson Hand

IF YOU'RE the kind of man who wants a suburban tractor, you probably are also the kind of a man who can tell a lot by looking at one. Cheap tractors look it. They don't have the guts in the chassis that you need. They are adorned with tinwear. Their wheels are skimpy, their belts long and winding.

If your lot is small and flat, and your needs minimum, go ahead and buy one. But if you can see yourself going deeper and deeper into tractoring, buy the tractor

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Suburban Tractor

one manufacturer was thinking about when he said:

"You've got to figure that maybe 10 or 12 years from now, you'll want to add another attachment. Will the tractor be able to handle it?"

As good a question: "Will the tractor still be running?"

More than 150,000 men who want to lessen yard-and-garden upkeep time will buy suburban tractors this year, according to industry estimates, and thousands more would like to. To help these men shop wisely, this year or later, POPULAR SCIENCE asked 15 tractor manufacturers for their views on the most important questions buyers have. Here's a summary:

What the experts say. First, if you are thinking about buying a suburban tractor mainly or exclusively to mow lawns, don't. Buy a good riding mower. It will cost less and probably mow better. But if there's a chance you might want a few of the more than three dozen wonderful and usefull attachments available, buy the tractor.

Second, if you do buy a tractor, don't settle for less than six horsepower unless the work you'll do is very light. Most

CONTINUED

before dropping into the tractor's seat

NO SINGLE tractor has all the features listed here, but if too many are missing—think twice. The features are a composite of what you should look for.

1 **Not less than 6 hp.** in a known-brand engine; probably not more than 10 unless you have a big lot.

2 **Chassis heavy enough** to connect front end to back; husky inverted channel or steel bar.

3 **Big wheels;** wide tires or heavy ribbed type if you expect heavy drawbar load.

4 **Minimum of three speeds** forward, one reverse.

5 **Power takeoff** available at the side (both sides preferably); also front and back.

6 **Clutch and brake** on one pedal, depending on how far you have depressed the pedal.

7 **As much comfort** as you need; a box for tool storage under the tractor seat.

8 **A differential**—ideally, a locking differential for maximum traction when you need it.

9 **Clearance** of from 7" to 9" under the tractor.

10 **Easy-steering front wheels** with enough tire to avoid digging into the lawn.

11 **A hood that covers** and protects, but opens easily.

12 **Headlights** for snowblowing or night mowing.

13 **Gas tank** you can fill without lifting the hood.

14 **Instrument panel** of the automobile type.

15 **A steering wheel** adjustable to different heights.

16 **A lever** to raise and lower attachments—long enough to give good leverage.

17 **Emergency brake,** handiest if there is one on each rear wheel, for sharp turns.

Next month:
How to shop for a riding mower

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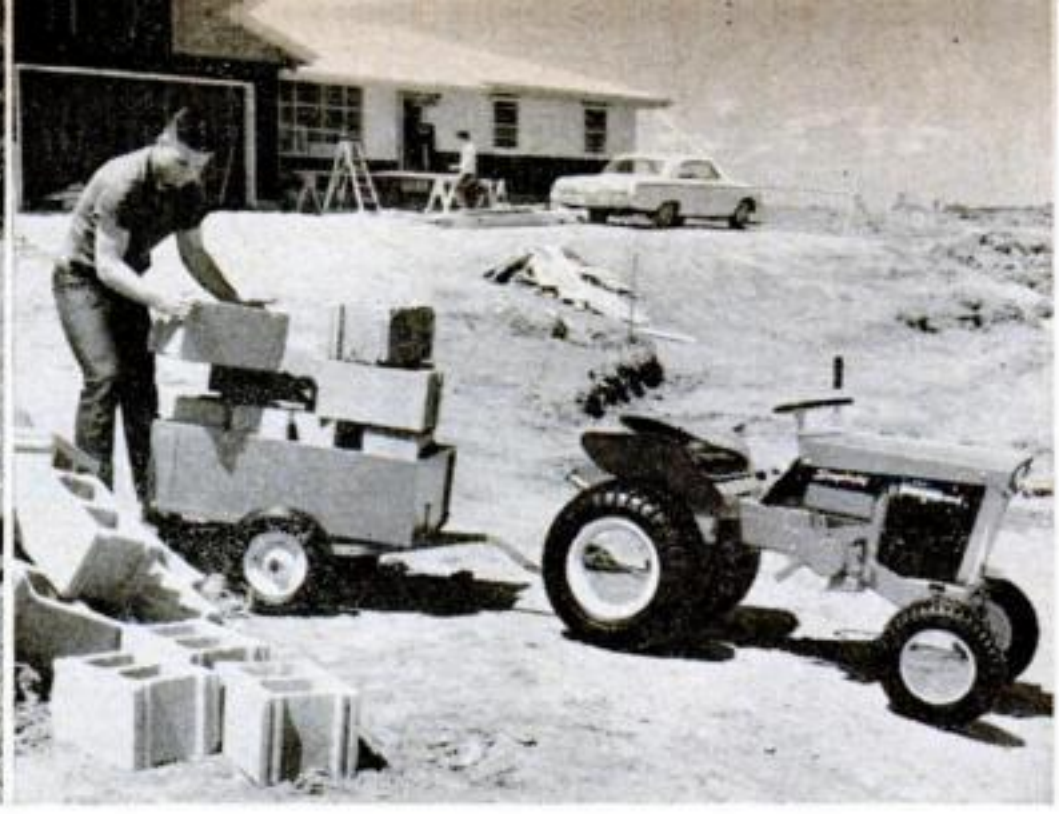

A VARIETY OF GOOD ATTACHMENTS

Most suburban tractors will handle most of the attachments listed here. Select yours on the basis of the jobs you'll want to do. Prices represent a low average.

Grader for moving a little dirt or snow, $29; dozer blade, for moving more dirt or snow, $37; snowblower, sizes to match most tractors, $150; two-wheel cart, to haul 500 lb. up, $64; sickle bar, for tall growth, $129; three-gang mower, for up to a 60" wingspread, $194; plow, 10" single bottom, $64; disk harrow, two-gang double frame, $40; rotary tiller, to take lots of power, $139;

tractor makers set six hp. as the bottom, and explain that anything less won't take care of the accessories you are sure to want.

"The engine power you need is determined by the size and type of attachments," one manufacturer said. "Our six-hp. model will operate a 32" rotary mower and a 32" snowthrower, but it would not pull a tiller satisfactorily. Nor will six hp. handle such attachments as a sweeper. Recently we exchanged a 7.25-hp. engine on one of our tractors for a 9, and noted significant improvement in operating a 42" rotary and a 36" snowthrower."

Says another maker: "We consider that 7 hp. is marginal for a 10" plow, but 9 hp. is ample. For a 60" rotary mower, we prefer 12 hp."

Sometimes the difference in cost is little more than the difference in the price of the engine. Some manufacturers put out a line of tractors identical except for engine size, offering, say, 6, 8, and 10. You can make your selection purely on horsepower. Sometimes, however, the six-hp. model is stripped down considerably to make the price low. Don't buy the smallest tractor in its cheapest version, unless there are strong budget reasons

What about physical size? Only a few inches separate the leading makes of tractors in height, length, width, and wheelbase. A good suburban tractor is about 39" high, 68" long, 35" wide.

A tractor has to be about that size to take attachments that sling underneath, between the front and rear wheels. Width is determined pretty much by safety factors. A narrow machine will tip over running across a slope or turning sharply.

Weight is a different matter—and a critical one. Some tractors are too light. The general range is from around 400 pounds to about 700 in the 9- or 10-hp. jobs. That 300-pound difference is usually steel, and you ought to have it for quality of construction even if you don't need it for traction. As a guide, one well-known, well-made tractor weighs about 675 pounds and costs about $675.

"Usable horsepower is determined to a great extent by weight," says one manufacturer. "Maximum power is used just as the drive wheels start to slip. Too little weight allows the wheels to spin before they transmit the maximum horsepower."

Weight distribution. This is important, too. There must be enough weight on the front wheels so they will steer, but if there is too much, it creates load. Some experts say about 65 percent of the weight should be on the drive wheels, 35 on front ones.

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MAKE ANY TRACTOR MORE USEFUL

spike-tooth harrow, $43; spreader, for seeds and dry fertilizer, $37; summer sunshade, $32; winter cab, $34; 42″ rotary mower, maximum for low hp., $120; 36″ roller, with a 24″ diameter, $36; dump cart, equal to several wheelbarrow loads, $80; 2,400-watt generator, for power anywhere, $140.

And in addition: a front-end loader, planter-fertilizer, big-capacity water pump, four-wheel wagon, sweeper, rotary rake, front-end carrying rack, side-mounting cord-wood saw, spiker-aerator, air compressor, and a hydraulic lift for the better use of a great many handy accessories.

Too much weight, of course, cuts into the lawn and bogs down in soft earth. For many tractor owners, wheel weights are the answer. When you need extra traction, you put on weights; around the lawn, you take them off. You can, incidentally, add about 125 pounds of drive-wheel weight by putting calcium chloride liquid in the tires. Of course, you can't put it in and take it out at will.

Most manufacturers say that the problem of wheel marks on the lawn disappeared with the use of wide-tread, low-profile tires, and that it never did exist with the larger, wider tires of the big tractors.

We asked the manufacturers which features they think a man should look for first in a tractor, and which he should pass up first, for economy. While stressing the importance of weight and horsepower, they also had this to say:

Versatility. "The most important consideration is versatility, which comes with attachments. A tractor can only do what the attachments can do." Attachments must be easy to put on and take off.

This is quite a factor. For the most part, the tractor makers do not make their own attachments. This means that in some cases you may need an adapter between the tractor and attachments. You should find out what complications this causes.

Attachments that require power (mowers, tillers, generators, pumps, etc.) must hook to a power takeoff. In some cases, this means belts. There's a pulley on the power takeoff, another on the attachment. Often this is a perfectly satisfactory arrangement, but look the hookup over to see what its potential for trouble may be.

Usually, if a tractor maker does turn out his own line of attachments, the linkage is slicker. In one case there is a splined power-takeoff shaft beneath the engine, and you hook up to it via a universal. This doesn't limit you to attachments the company makes; you can slip a sheave on the spline and hook to other attachments by pulleys.

You should never buy a tractor without looking over the attachments. Those commonly available are listed above.

What features are least needed? Manufacturers mention excess horsepower first. In other words, while they urge you not to *under*power yourself, they also urge you not to *over*power. Other things they say you should be able to live without, to save money, include:

Electric starting on lower horsepower, sheet-metal trim of no functional use, extra-

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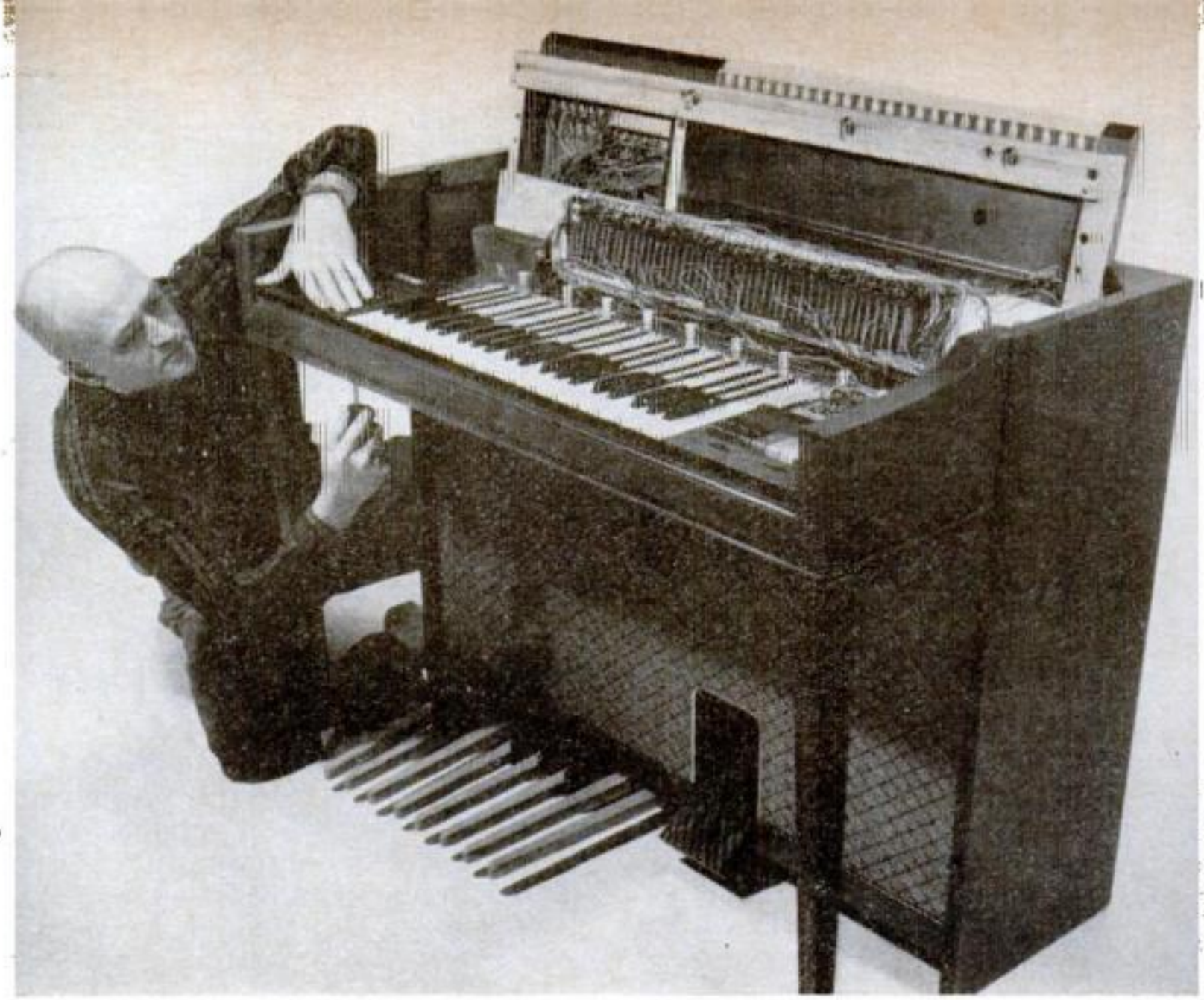
Personal-use report



You Build This Electronic

By Hubert P. Luckett

HERE'S a versatile, theater-type, electronic organ you can build from a kit. You can save about $400 and count on about 75 hours of fun building it. You don't have to be an expert or know anything about electronics to complete the project.

While there is little doubt that you could finish the job in that 75 hours if you are persistent, reasonably good with your hands, and can follow directions exactly, it will probably take substantially longer if you've had no previous experience building electronic kits.

The transistor is largely responsible for making possible an electronic organ that can compete in price and size with the piano as the major instrument for home-made music. Ingenious circuit design in this kit-built job takes the development a step further and gives you much of the versatility and many of the special effects of a theater organ. You can produce not only the familiar sounds of wind and string instruments, but those of percussion instruments like the piano and banjo. It even has 28 notes of chimes that sound unbelievably realistic.

Although the finished instrument looks formidable to build when you look inside, the Heath engineers have done an excellent job of programing the assembly so that you are never confused or overawed by what lies ahead of you.

The kit comes in six subpacks and the instructions are written so that you complete one and install it in the case before you open the next. The entire job is about comparable to building six hi-fi amplifier or tuner kits.

Much tedious wiring is avoided by generous use of printed circuit boards and PEC (printed electronic component) modules. One major circuit board (keyer circuits) comes completely assembled and ready to install. Color-coded, prefab cables are sup-

CONTINUED

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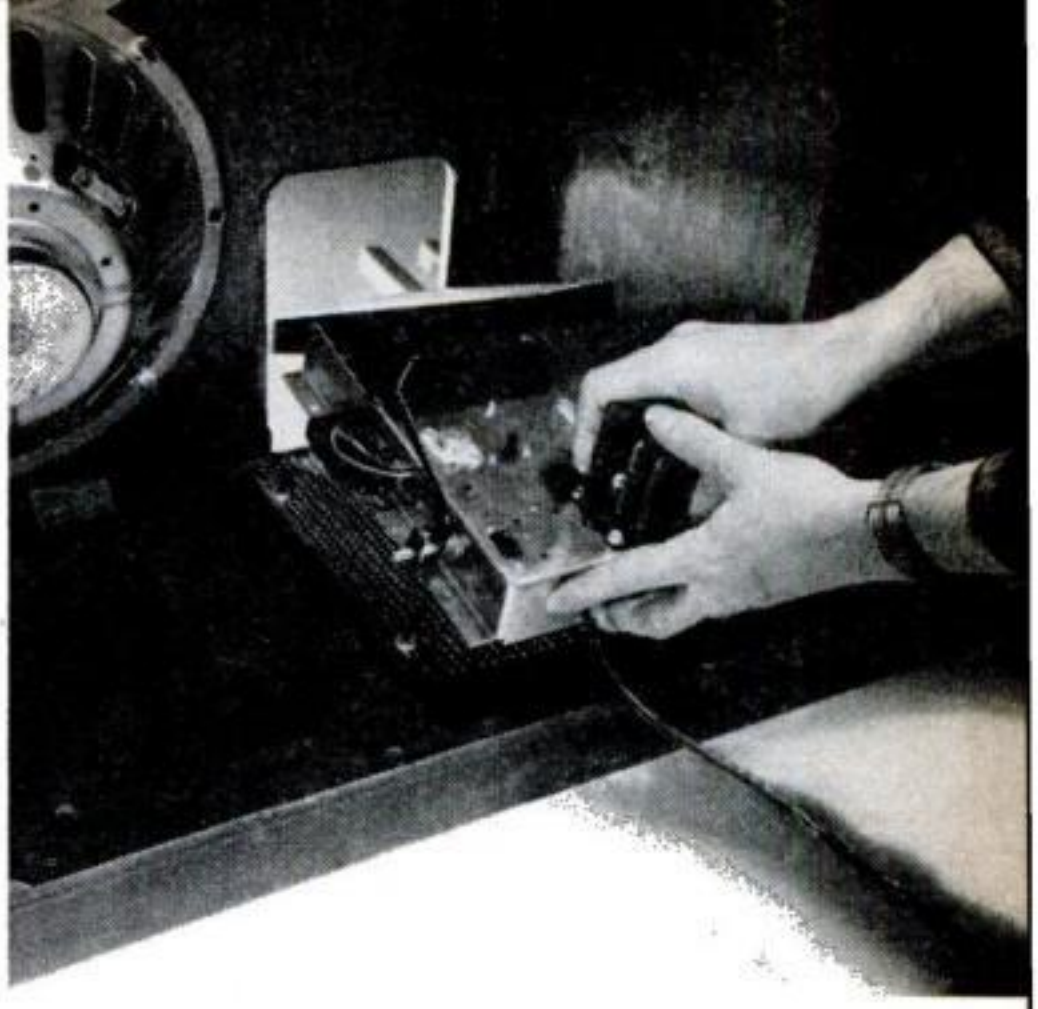
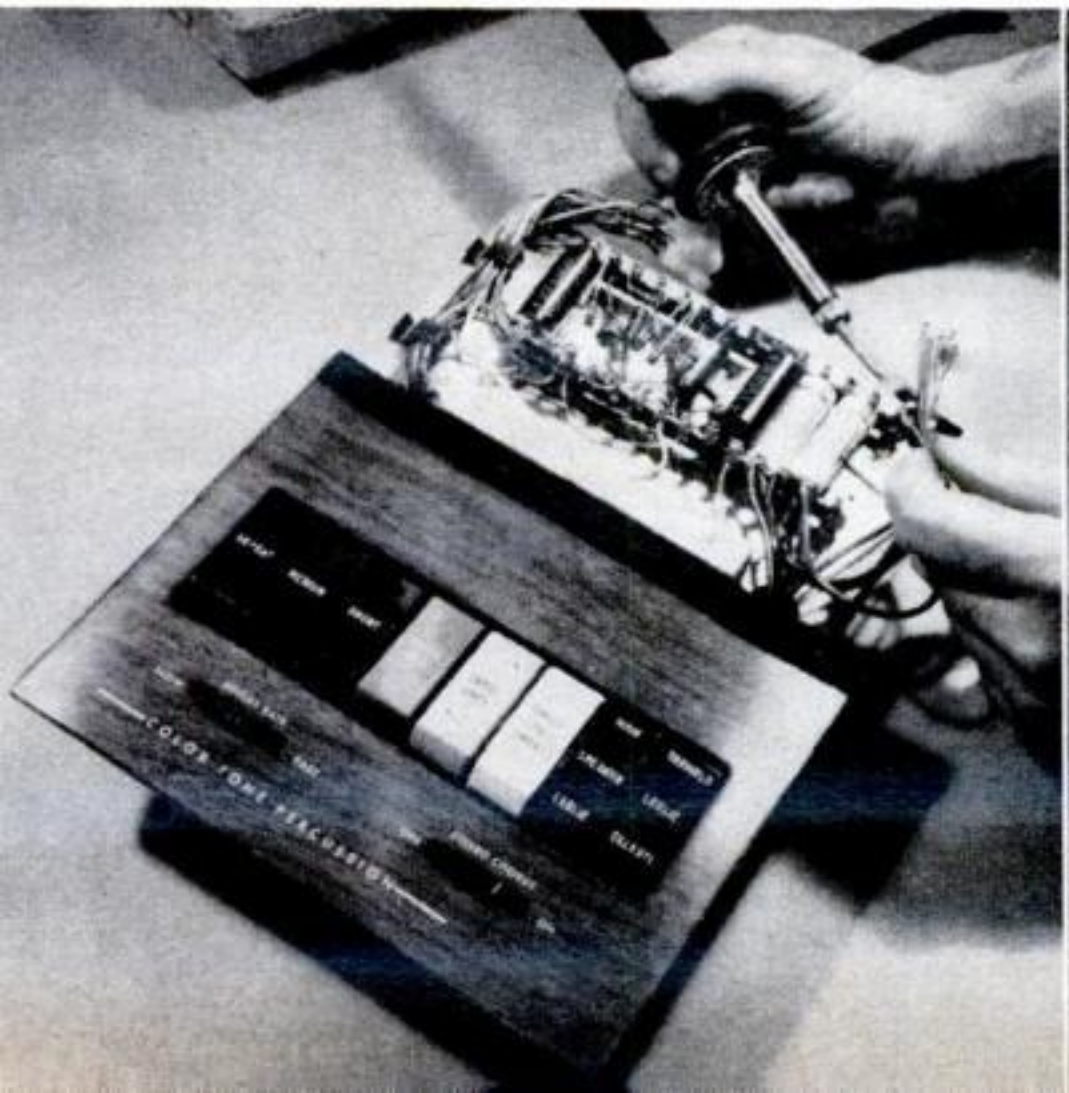
Here's what you get for your $849: A 17-voice organ in a walnut case with two keyboards, a 13-note pedal board, a matching walnut bench—and about 75 or 80 hours of fun assembling it. You save $400 or more over the cost of a comparable ready-made instrument.



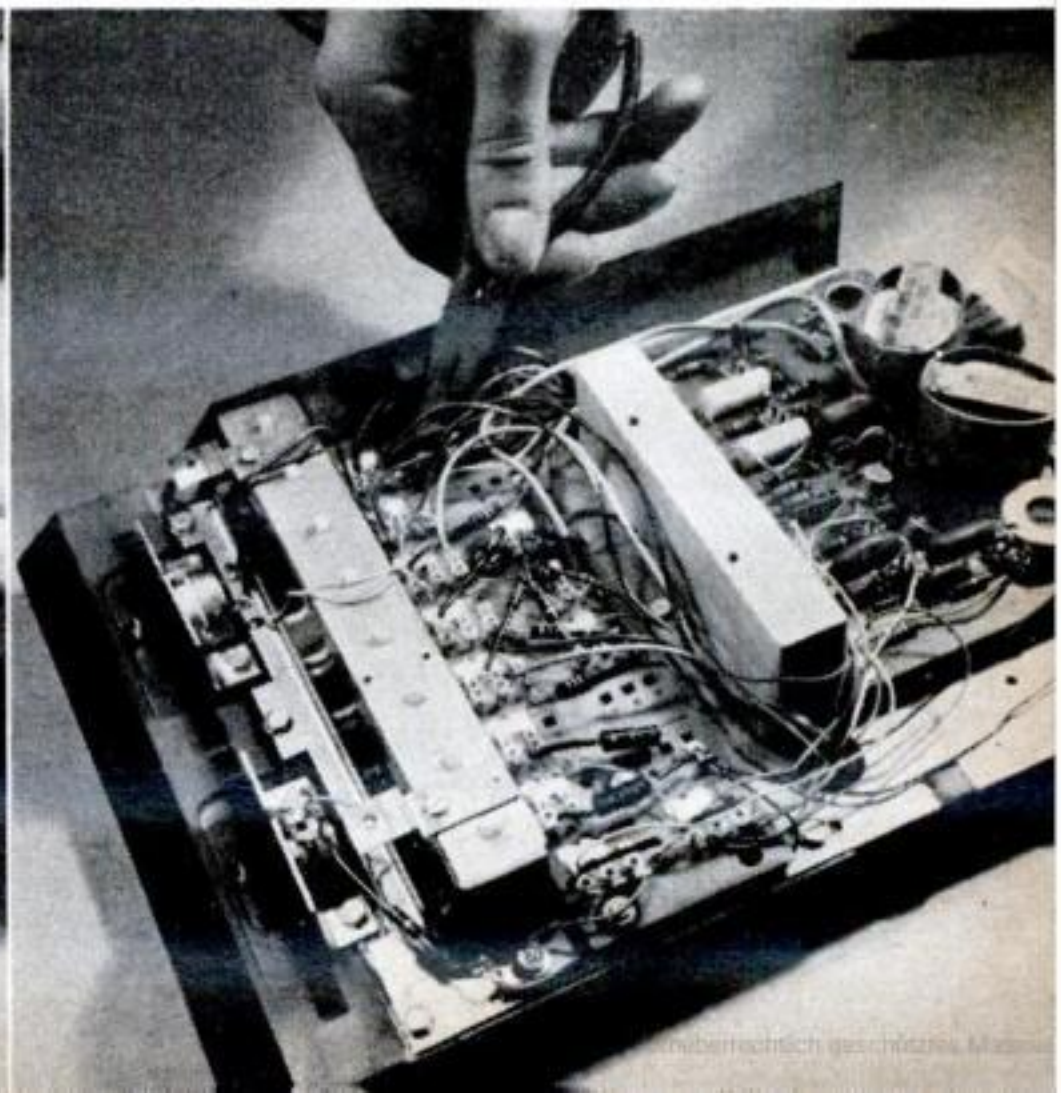
Power amplifier is all-transistor, delivers 37½ watts of music power. Swell pedal, mounted on the amplifier chassis, controls the volume through a mechanical linkage attached to the shaft of the amplifier volume control. Twin main speakers are at upper left.

Organ from a Kit

PS ELECTRONICS

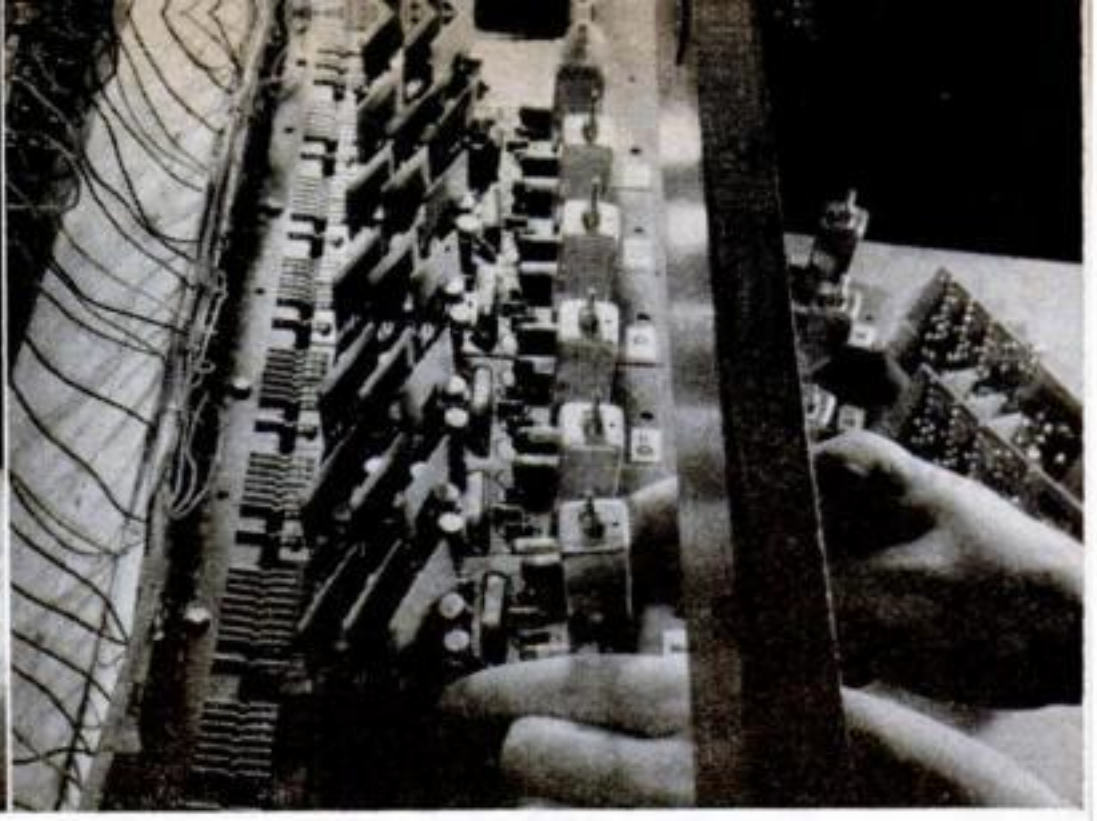


Percussion tones—sounds like the notes from a piano, guitar, or similar instruments in which sound is made by striking or plucking—are produced when a tab switch on this percussion cheek block is turned on. All the percussion tone-shaping circuits are in this chassis.

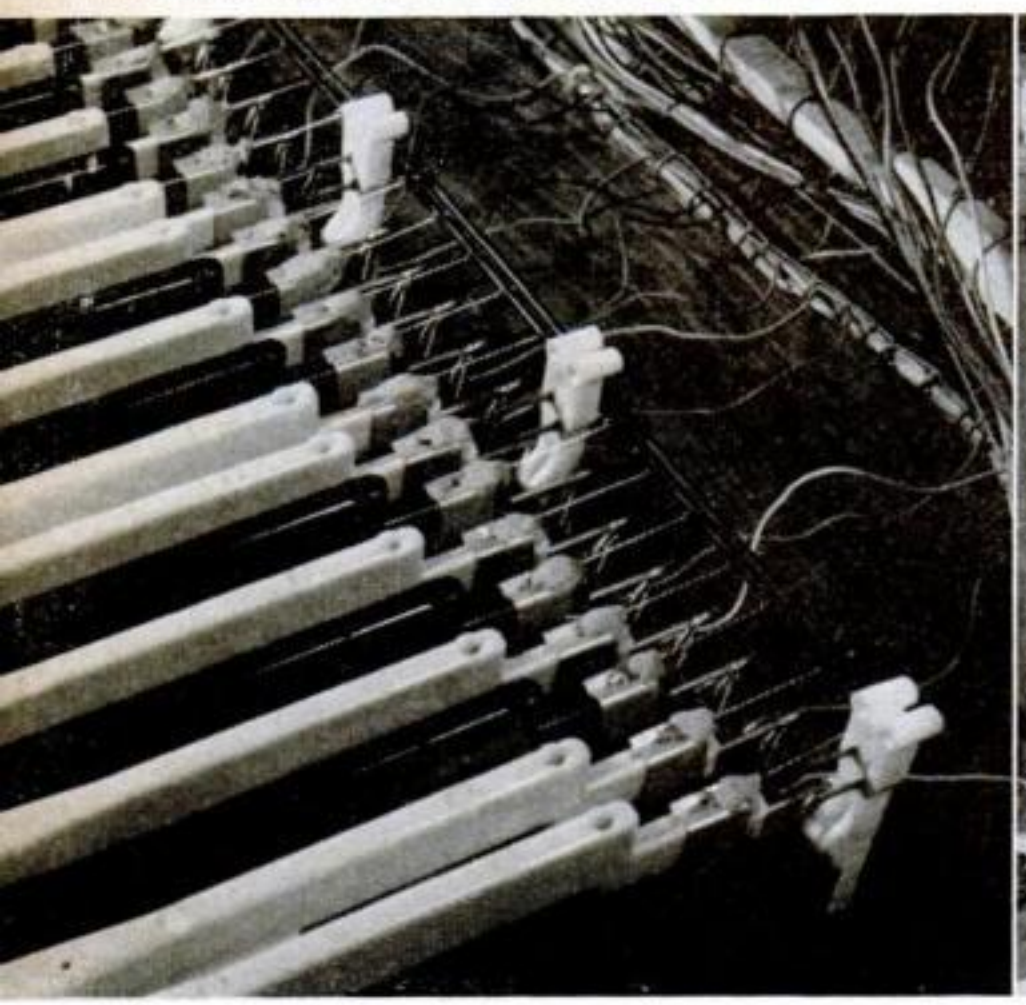


Underside of the percussion cheek block (below) shows the arrangement of the slide switches controlled by the tabs. Mechanism is similar for tabs controlling voices of great (lower) and swell (upper) manuals. Each module is built as a separate subassembly.

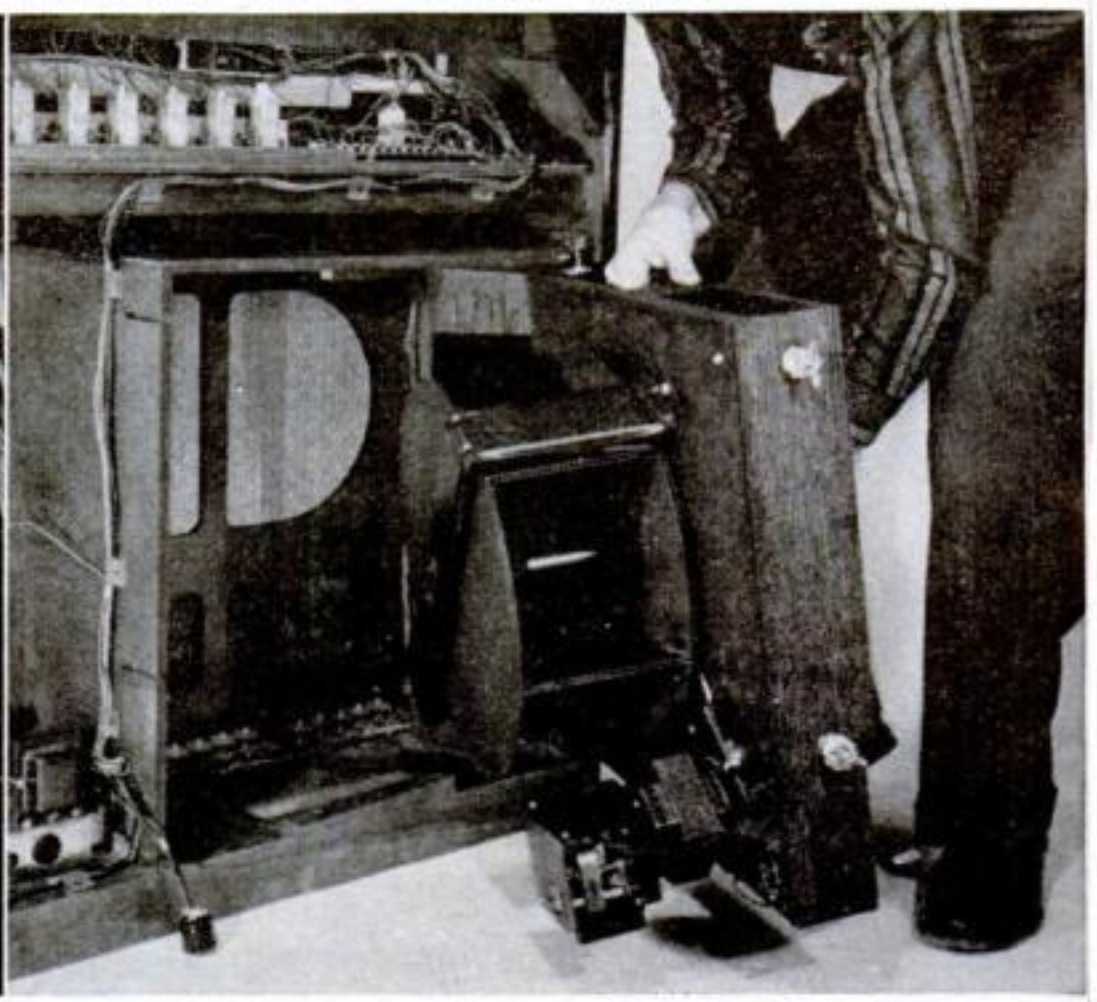
Tone generators are built on individual circuit boards. There are 12 in all, one for each note in the chromatic scale. One comes already built and accurately tuned to C at the factory. You use this pretuned generator to tune the rest.



Computer-style design makes installation of tone generators as easy as plugging in a table lamp: Push one end of the circuit board into a positive-grip connector. Each tone generator is identified by the note it produces: C, C#, D, D#, etc.



Close-up shows contacts on the great keyboard. A slender bronze contact wire, on the end of the key, extends between two bus wires. At rest, it contacts lower bus; when key is depressed, it contacts the upper one.



The Leslie speaker shown above consists of a motor-driven rotor mounted in front of a dynamic speaker. It produces a tremolo effect and diffuses the sound so that the sound seems to come from a much larger area.

plied with connectors already attached. These save a lot of time and reduce the possibility of error in interconnecting the various circuit boards and key switches.

It took 75 man-hours to complete my instrument. Unlike most kits you've seen, this one can be worked on by several people at a time without their getting in each other's way. My wife and son often joined in the fun, especially with the mechanical assembly.

All tones begin in the 12 tone generators (one for each note in the musical scale). Each generator produces the signal for a particular note in every octave. There is a master oscillator output and the outputs from three frequency dividers from each tone-generator circuit board. The output signal from any divider is exactly half the

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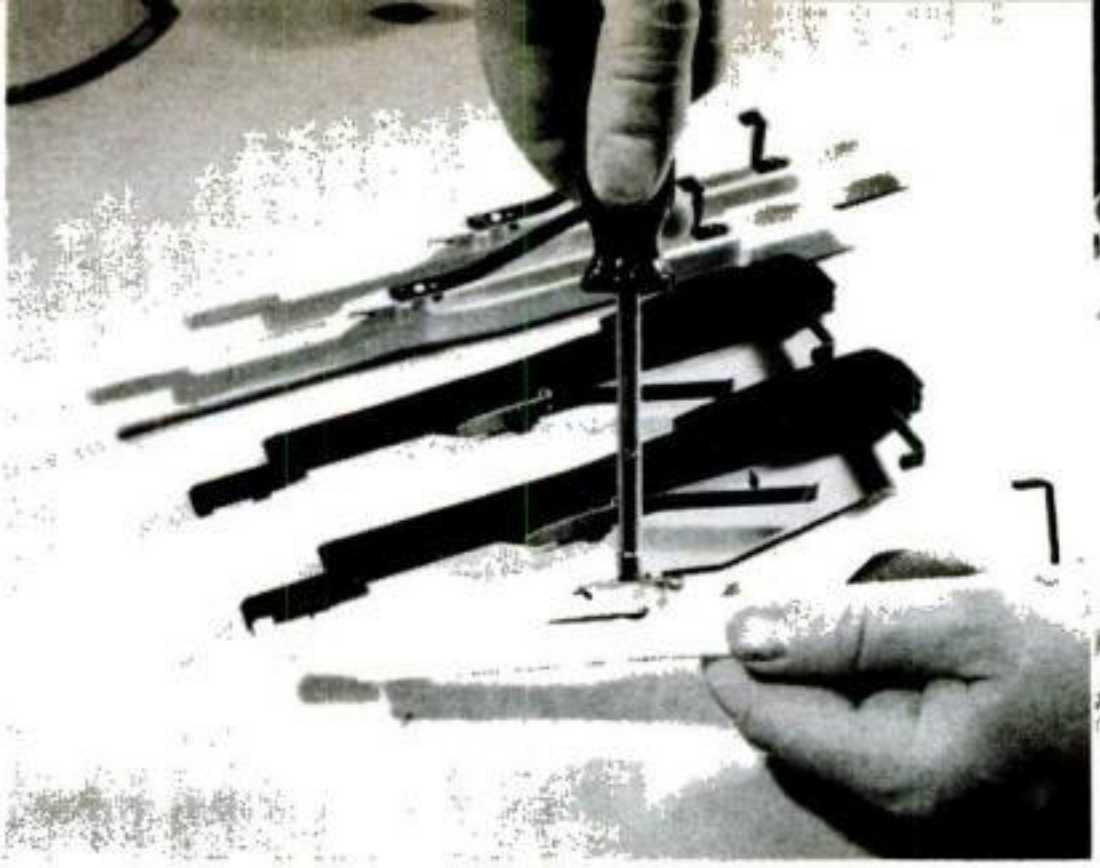
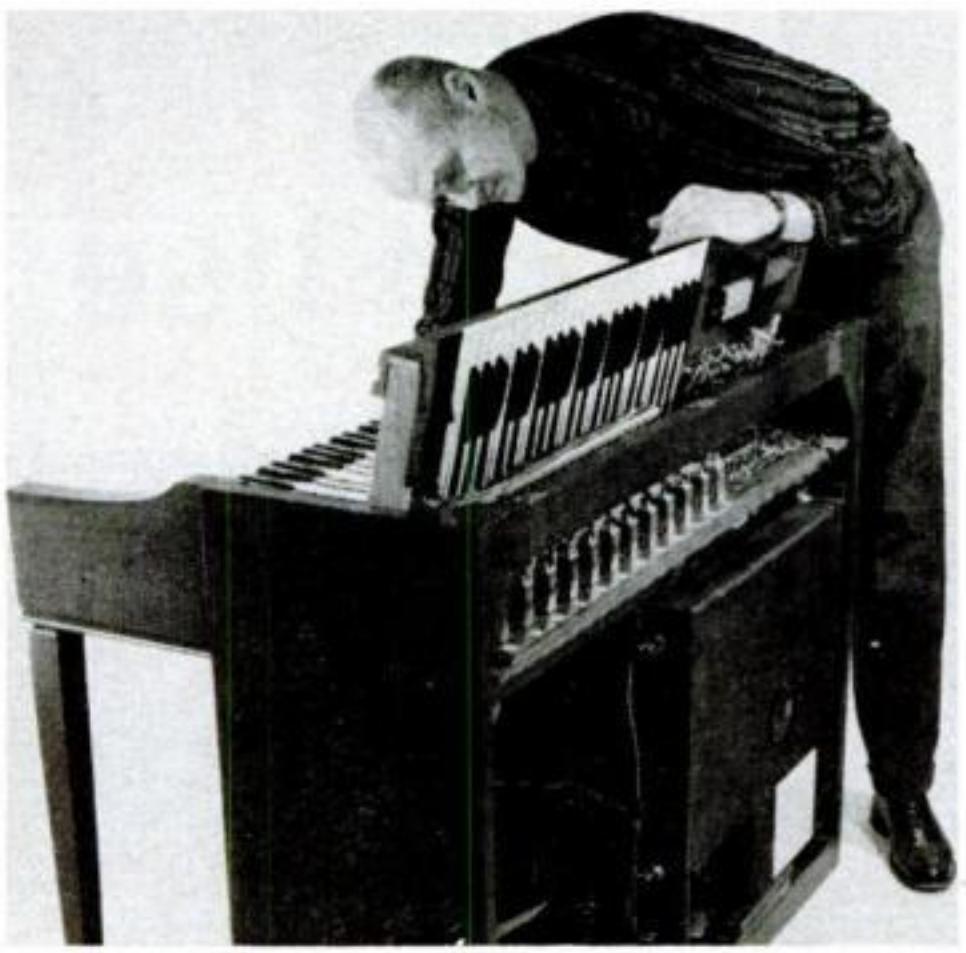


Much of your kit-building time is spent on mechanical assembly. Return spring, pivot spring, and key-stop bracket are attached to the molded-plastic keys with self-tapping screws. Here's where you can enlist aid from the family.

To assemble the individual keys into a complete keyboard, you simply hook the end of the pivot spring under a knife edge on the key rack—and push. Key snaps in place with knife-edge pivot nestling in a V notch in the key.



Swell keyboard is mounted in a tray held in place by hinges for easier access during final wiring (shown being done above), and to simplify future servicing. Two long machine bolts hold it securely in playing position for normal use.

Tuning the assembled organ requires no special musical ear. Each tone generator is tuned by a simple screw adjustment. Accompanying instructions tell you exactly how to use pretuned C generator as a reference for tuning the others.

frequency of the input signal. So you only have to tune 11 master oscillators (C comes factory-tuned), and all the other notes are automatically in tune.

When a key is depressed, the signal from a particular tone-generator output is selected and sent to the voicing circuits. Here the tone is modified to give it the character of the particular instrument you have selected by depressing a particular voicing tab switch. Other circuits, also controlled by tab switches, can provide such effects as vibrato, sustain, reverberation, percussion, repeat, tremolo.

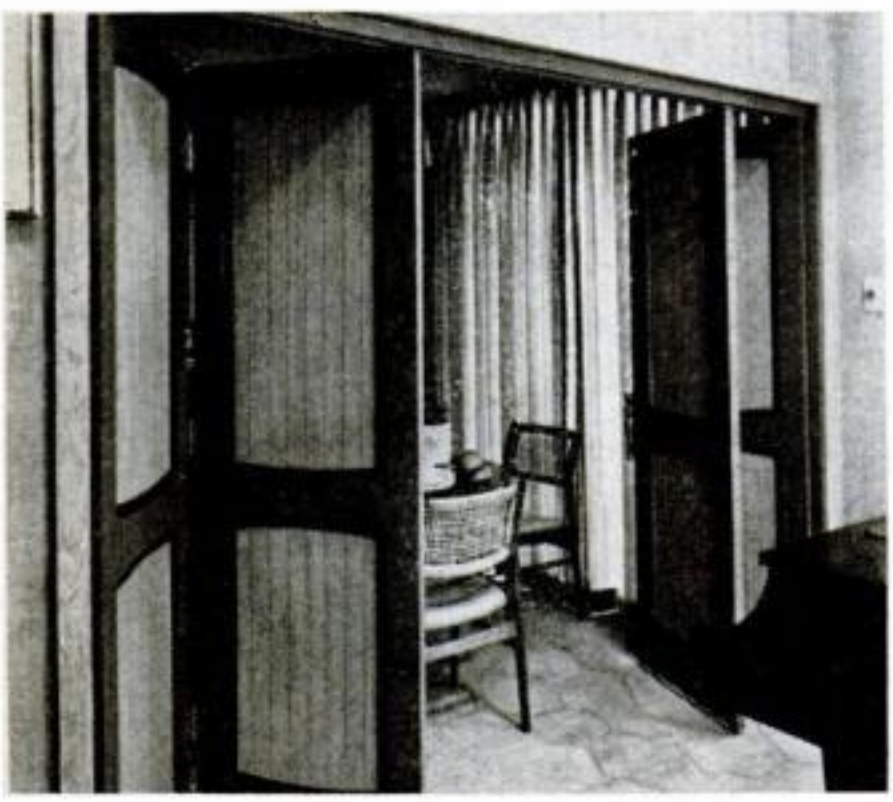
Called the Thomas by Heathkit, model GD 983, the kit, including bench, sells for $849 by mail order from the Heath Co., Benton Harbor, Mich. ■ ■

Urheberrechtlich geschütztes Material

New suspended ceiling has box beams, too

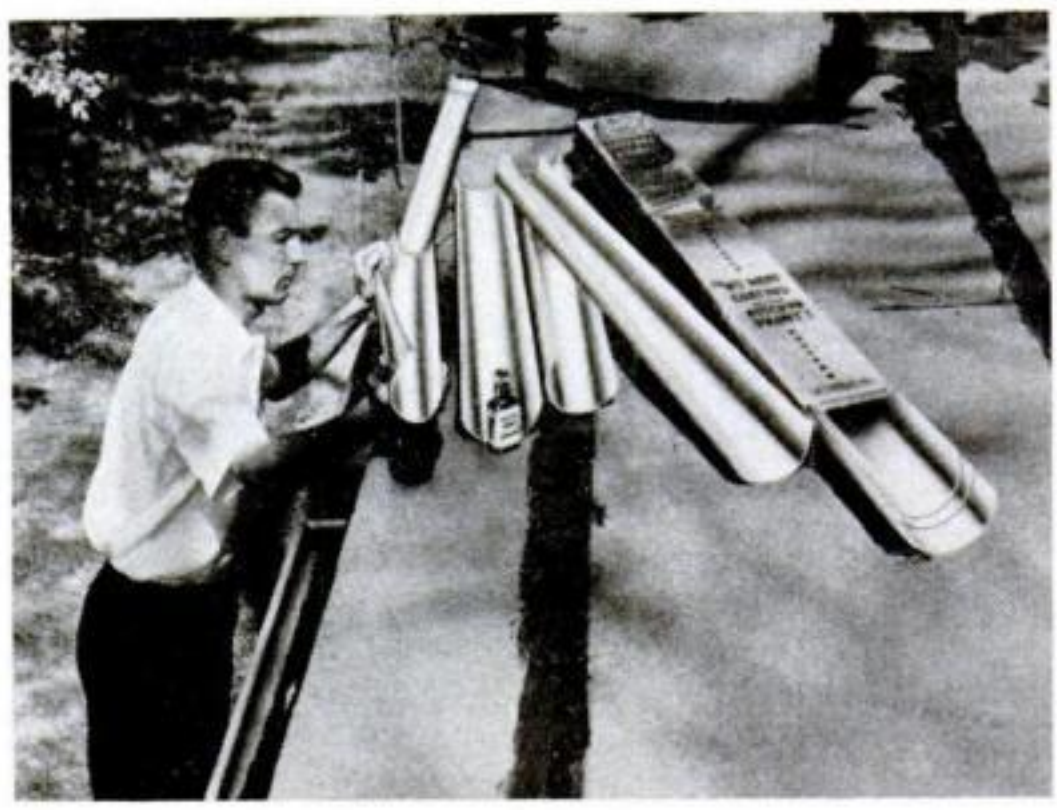
If you like the decorative appeal of exposed beams, you can now have them along with a new suspended ceiling. Armstrong Cork Co. offers the combination. Like other ceiling systems, this one has a metal grid suspended by wires to support 2′-by-4′ acoustical panels. The beams, made to resemble wood, are a part of the supporting grid.

Products You Can Use



Doors now come in designer styles

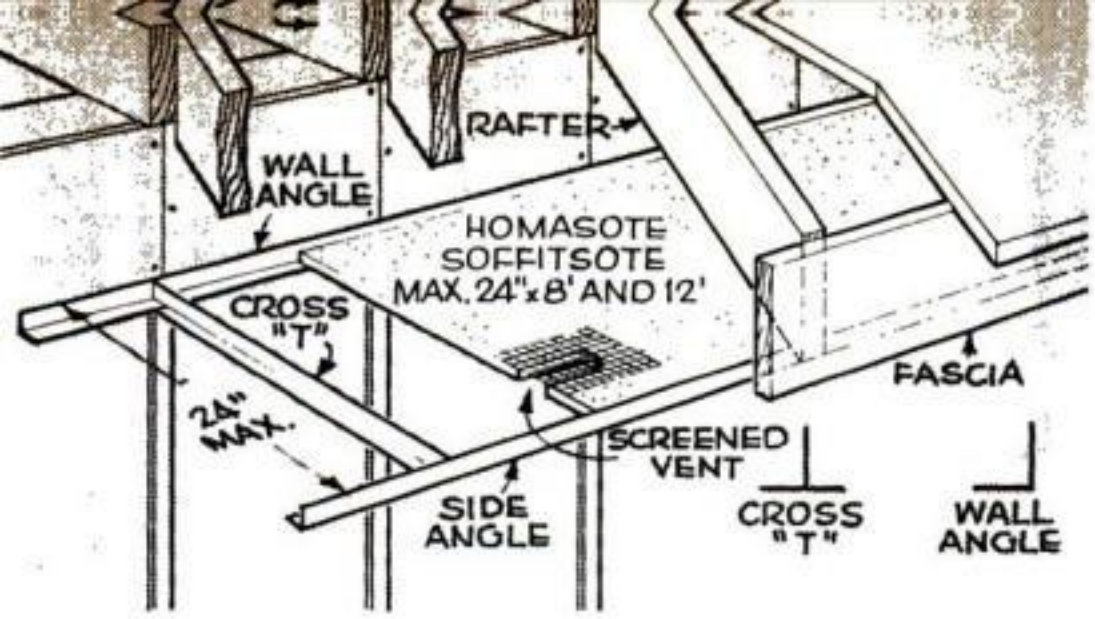
Four new door designs have been created by Walter Dorwin Teague Associates for Simpson Timber Co. This photo shows only one of the designs—four Sonata Symphonic doors that are hung as a bifold unit in the passageway between a dining room and family room. The doors have curved rails, planked panels, and three paint tones.



Aluminum liners to save old gutters

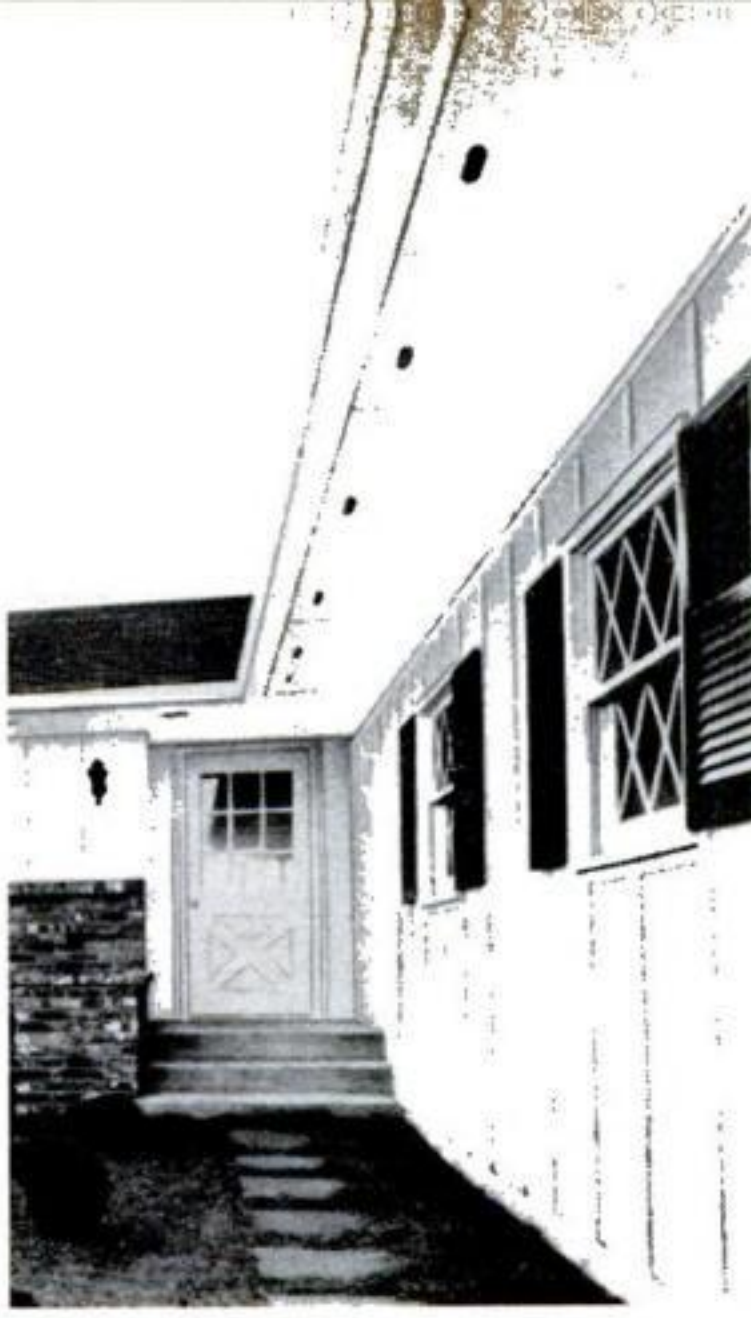
If your present gutters show signs of rusting or rotting out, a product called Gutter Armor may be the solution. Packaged as eight 4′ preformed aluminum strips, the material can be shaped to fit the old gutter exactly. You apply it with waterproof adhesive, cut it with scissors. Cost is about $7 from Imagineers, Milford, Conn.

Urheberrechtlich geschütztes Material

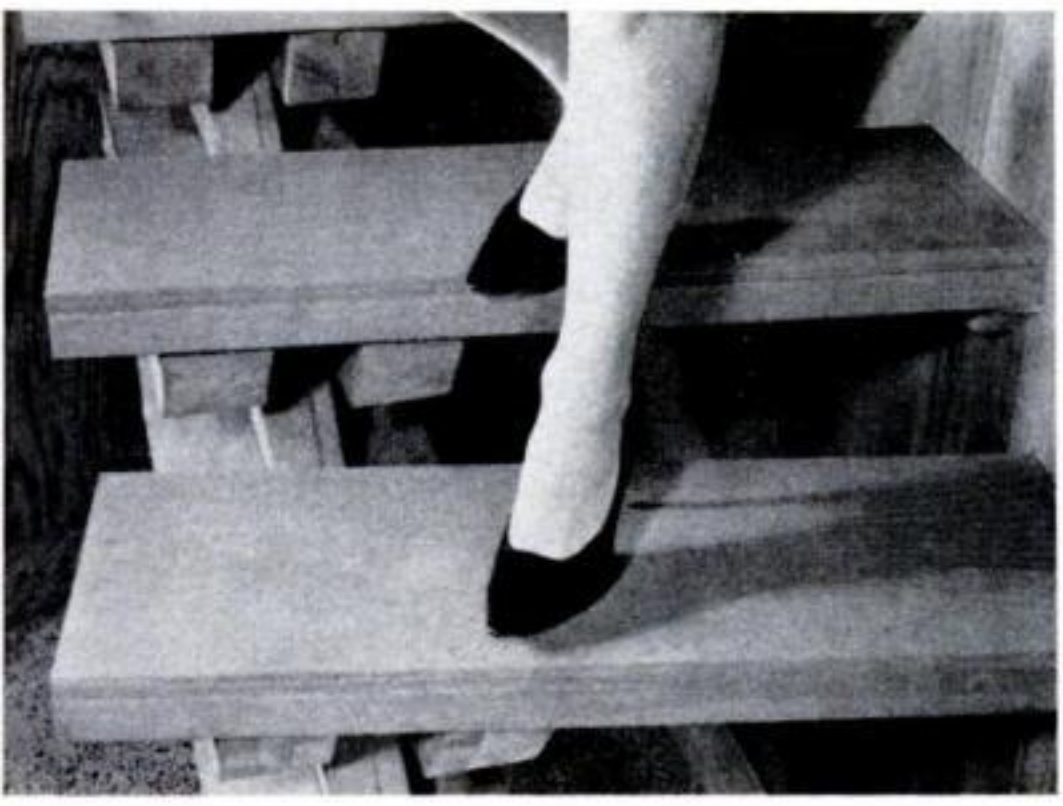


Nail-free under-eave soffits are easy to install

A nail-free method of installing under-eave soffits, recently announced by the Homasote Co., Trenton, N.J., is said to save the house builder both time and money. The soffit consists of weatherproof Soffitsote panels, fitted at the factory with screened vents and cut to 8′ and 12′ lengths. The panels rest on a drop-in grid framework, and are installed as shown in the drawing above. The grid is made up of L-shaped and T-shaped metal angles, standard parts commonly used for suspended ceilings.



to Improve Your Home



New plywood has nonskid surface

You can improve the footing on basement stairs and other danger areas by installing Simpson Timber's new Skid Guard. The material consists of a waffle pattern formed in a plastic-impregnated overlay which is bonded either to exterior-type fir plywood or on hardboard laminated to plywood. It can be used both indoors and outdoors.

What to do about an old floor

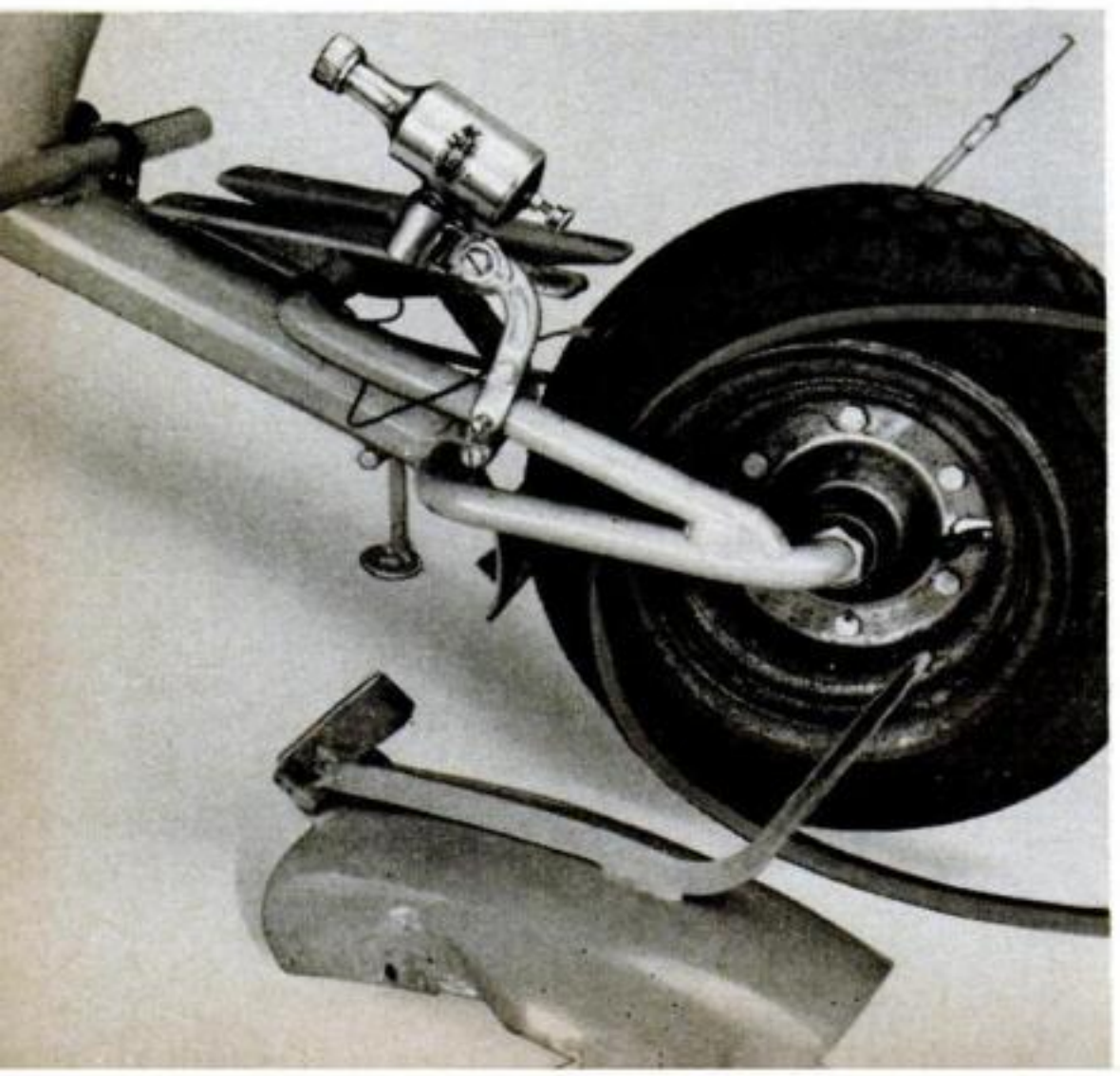
You can upgrade your floor with a durable new material—hardwood veneer embedded in vinyl and styled to look like random-pegged planking. The planks come in 48″ lengths, 4″, 6″, and 8″ widths—in walnut, cherry, oak, and mahogany. Wilcox-Woolford Corp., Spring City, Pa., makes it. Cost: about 75 cents a square foot.

Urheberrechtlich geschütztes Material

PS PROJECTS

Two SCOOTERS

Fueled up, the featherweight Popcycle is ready for a day of cruising almost anywhere. Only exceptions are certain high-speed superhighways. Below: rear-axle arrangement with engine removed. Bike generator, shown on swivel mount, rides on engine pulley to supply electricity for lights. Main frame tubing is from auto propeller shaft.



This one is made of STEEL

By Joe McBride

TWENTY-FIVE pounds of used auto and bike parts bought at a salvage yard for 7 cents a pound ($1.75 total) make up the frame of my Popcycle scooter. You can easily build one like it, if you have access to welding equipment and a lathe.

My rig is powered by a three-horse Briggs & Stratton mill, but any lightweight engine will do. A four-cycle job is best for easy starting, smooth running at low speeds, and the convenience of not having to mix gasoline and oil. Avoid a heavy, cast-iron model. Its off-center weight makes balancing and steering difficult. And be sure to use pneumatic-tired wheels with precision ball or roller bearings, unless you whip up a junior scooter for speeds below 15 m.p.h. Tire diameter is optional; I settled for 11", but the integral half-forks and axles can be modified for larger sizes.

Another option is the drive. Unless you live where the hills are steep, a low-cost hookup with good dig-out characteristics involves no more than a V-Plex clutch, a heavy-duty neoprene V belt, and pulley. Besides accelerating better than a chain-drive

[Continued on page 168]

Urheberrechtlich geschütztes Material

You Can Build

This one is made of WOOD

By J. M. Harris

NO WELDING rig in your shop? You can still build your own transportation, as I did, using simple hand tools, wood, and readily available hardware. Most of the scooter frame is made of 1¾"-square oak and 1¾"-by-¾" oak. You'll need 28′ of the former, 34′ of the latter.

Following the layout plan on the next page, saw out the members. Make only one each of parts 7, 16, and 19; four of 9, 12, 15 and 17; two each of the others. Bore holes as indicated (unless specially noted, the diameter is 5/16"). Omit the intermediate holes in two of parts 17 and 9. Assemble the frame with 5/16" carriage bolts.

Form the seat parts as shown. After tacking down the canvas, glue the covered pad in place. Cut out and screw footboard 18 to parts 1.

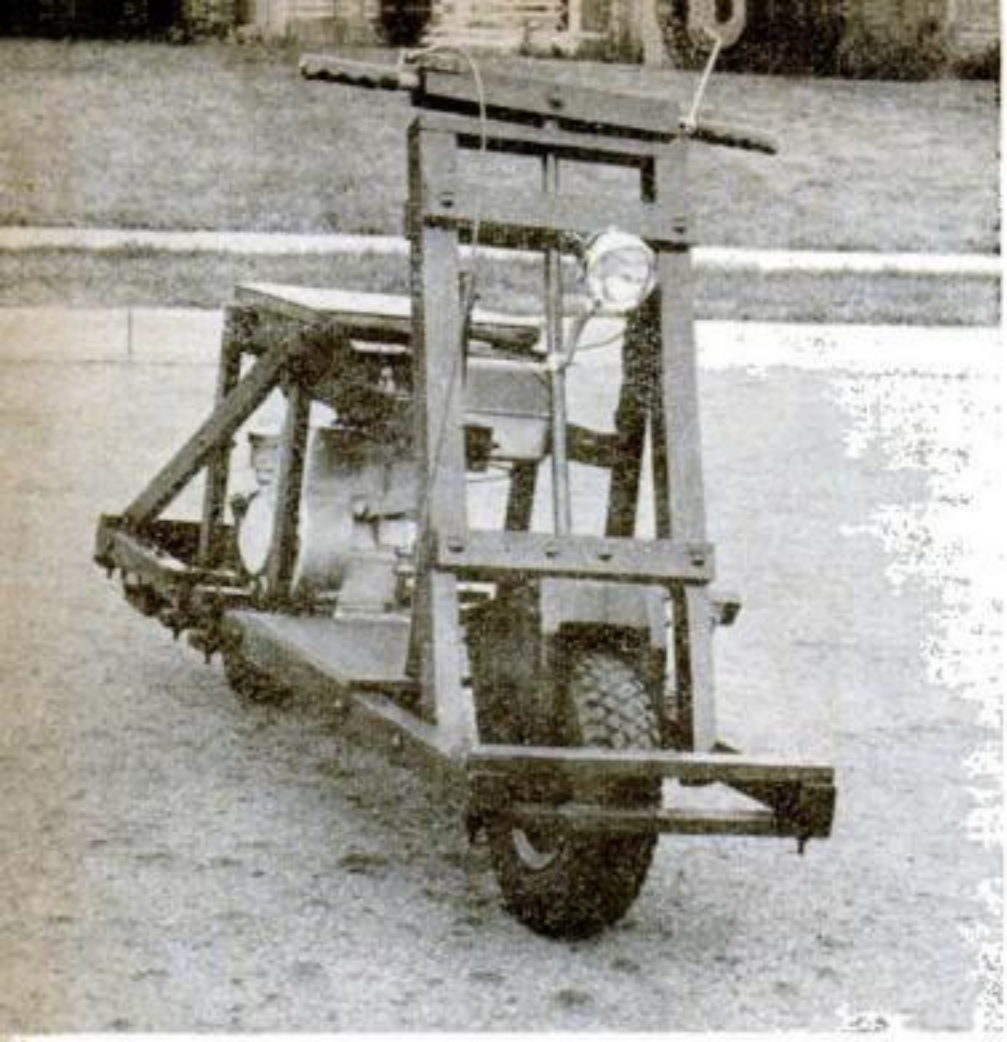
Glue maple dowels in the ends of handlebar part 19. Slip steel tubes over these, cementing the left one to the dowel with epoxy glue. The one on the right is worked to a free fit for a twist throttle (note setup in plan). Run the cable through the footboard slot behind part 8.

From ¾"-diameter cold-

CONTINUED

Road-tested for 300 fun miles, this wood scooter is a curbside conversation piece and a rugged, dependable performer. It climbs stiff hills briskly, cranks out half a mile a minute on the flat. It's licensed, but its builder cautions: "Save your bills of sale for the engine, wheels, and clutch. Some states require them before they will issue a license.

Urheberrechtlich geschütztes Material

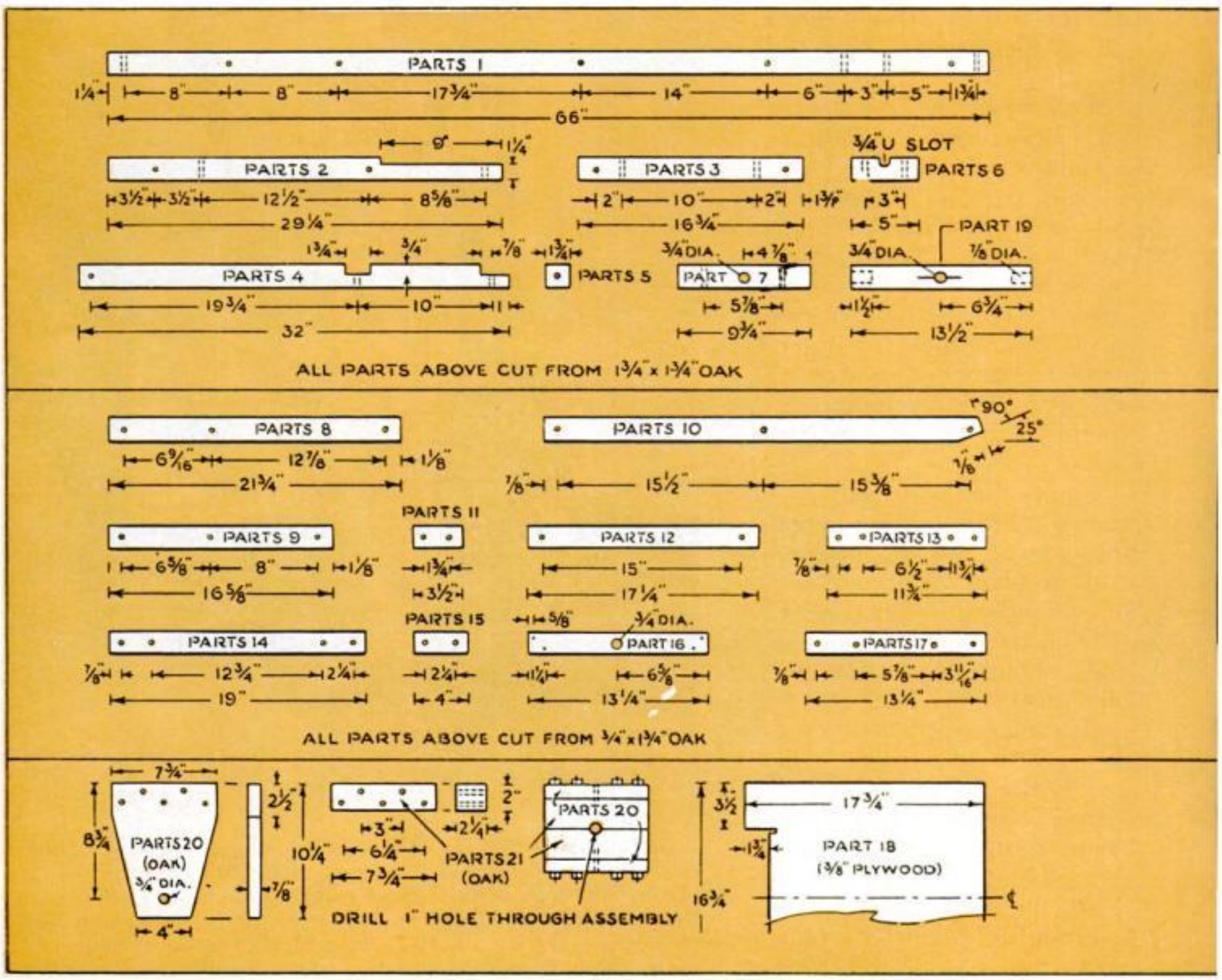


Named Pioneer, the wood scooter tips the beam at 120 pounds, carries twice its weight in riders. A special servicing note: Snug up the carriage bolts after you've rolled up the first 50 miles.

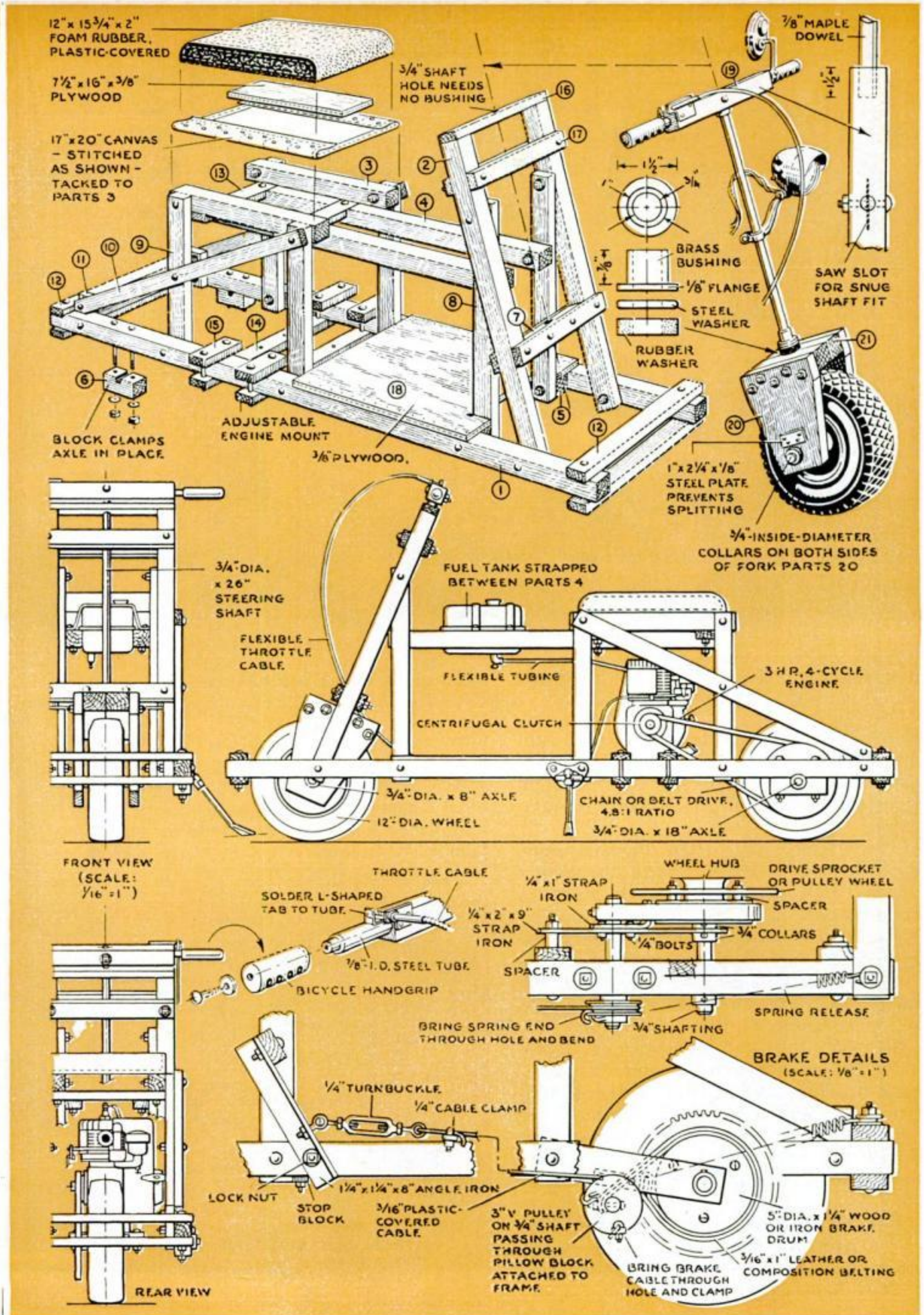
rolled steel, cut a 27″ steering column, an 8″ front axle, and an 18″ rear axle. Insert the top of the column in the handlebar hole and drill through it for a bolt (see drawing). Slip a collar on the column and work the shaft through the hole in 16. Where it passes through 7, apply a bushing, followed by steel and rubber washers. Oak-fork parts 20 and 21 are assembled with epoxy glue and threaded rods and nuts.

The drive is through a centrifugal clutch —your choice of a chain or belt connection to the rear wheel. A drawing shows the braking. If you use pulley wheels instead of slim sprockets for the drive, you may have to recess the inboard axle collar on the left into frame part 1 to give clearance for drum and hangers. Finally, strap the headlight battery to 13. ■ ■

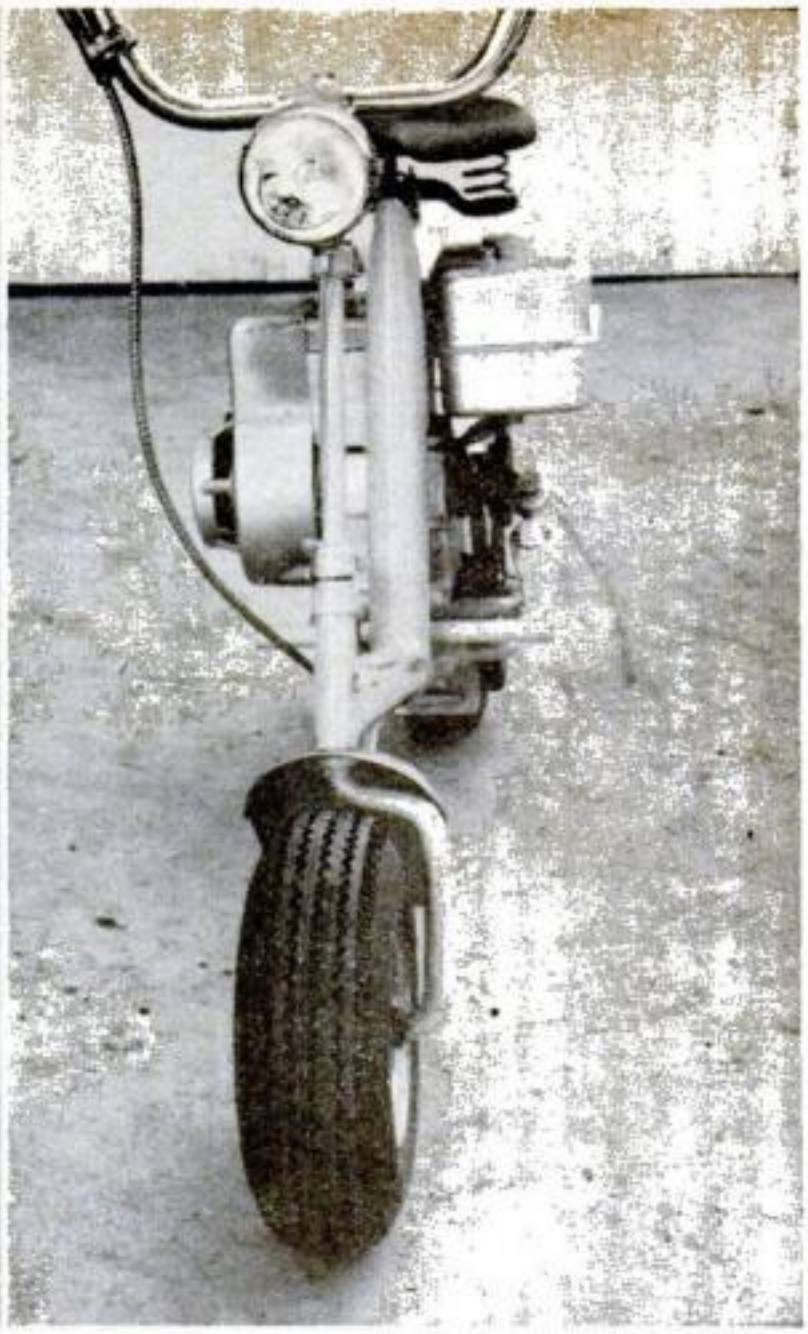
For detailed plans and further building hints, send $3.25 to J. M. Harris, 476 Park Overlook Dr., Worthington, Ohio.



Urheberrechtlich geschütztes Material


12" x 15¾" x 2" FOAM RUBBER, PLASTIC-COVERED
7½" x 16" x ¾" PLYWOOD
17" x 20" CANVAS – STITCHED AS SHOWN – TACKED TO PARTS 3
¾" SHAFT HOLE NEEDS NO BUSHING
⅞" MAPLE DOWEL
1½"
SAW SLOT FOR SNUG SHAFT FIT
1½"
¾"
BRASS BUSHING
⅛" FLANGE
STEEL WASHER
RUBBER WASHER
⅛"
BLOCK CLAMPS AXLE IN PLACE
ADJUSTABLE ENGINE MOUNT
⅜" PLYWOOD.
1" x 2¼" x ⅛" STEEL PLATE PREVENTS SPLITTING
¾"-INSIDE-DIAMETER COLLARS ON BOTH SIDES OF FORK PARTS 20
¾" DIA. x 26" STEERING SHAFT
FUEL TANK STRAPPED BETWEEN PARTS 4
FLEXIBLE THROTTLE CABLE
FLEXIBLE TUBING
3 H.P. 4-CYCLE ENGINE
CENTRIFUGAL CLUTCH
¾" DIA. x 8" AXLE
12" DIA. WHEEL
CHAIN OR BELT DRIVE, 4.8:1 RATIO
¾" DIA. x 18" AXLE
FRONT VIEW (SCALE: 1/16" = 1")
THROTTLE CABLE
SOLDER L-SHAPED TAB TO TUBE
⅞" I.D. STEEL TUBE
BICYCLE HANDGRIP
WHEEL HUB
DRIVE SPROCKET OR PULLEY WHEEL
¼" x 1" STRAP IRON
SPACER
¼" x 2" x 9" STRAP IRON
¾" COLLARS
¼" BOLTS
SPACER
SPRING RELEASE
BRING SPRING END THROUGH HOLE AND BEND
¾" SHAFTING
BRAKE DETAILS (SCALE: ⅛" = 1")
¼" TURNBUCKLE
¼" CABLE CLAMP
1¼" x 1¼" x 8" ANGLE IRON
LOCK NUT
STOP BLOCK
3/16" PLASTIC-COVERED CABLE
3" V PULLEY ON ¾" SHAFT PASSING THROUGH PILLOW BLOCK ATTACHED TO FRAME
5" DIA. x 1¼" WOOD OR IRON BRAKE DRUM
3/16" x 1" LEATHER OR COMPOSITION BELTING
BRING BRAKE CABLE THROUGH HOLE AND CLAMP
REAR VIEW

Urheberrechtlich geschütztes Material



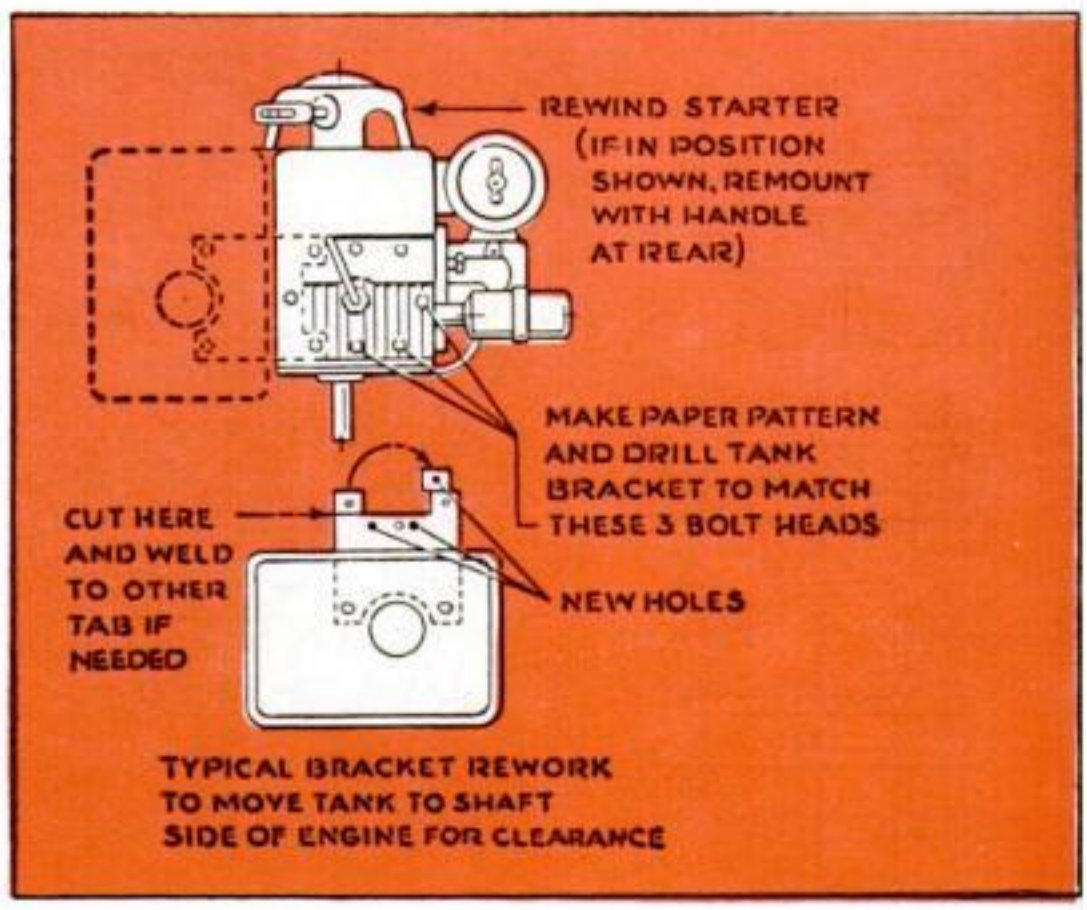
"Ape-hanger" handlebars qualify you to ride with the wild ones—but for transport in a car or boat, you may prefer the conventional butterfly type. Slim contour of Popcycle is eye-catching. Both the front and the rear wheels are mounted on integral axles and half-forks.

clutch, the alignment between engine and driven pulley is not as critical. For mountain climbing, however, use a kart clutch, sprockets, and chain. A 1:6 reduction ratio is fine.

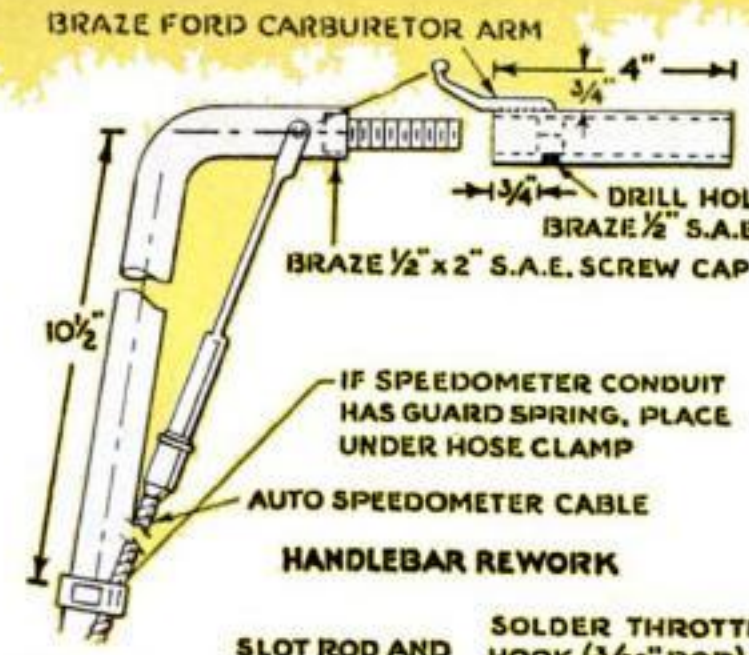
The assembly and detail drawings show the adaptation of junked parts to the scooter frame. Both the front-fork and rear-axle assembly are made from ¾" auto sway-bar stock, which must be heated cherry red and straightened, then *slowly* cooled, before machining and shaping. To reharden, the completed parts are reheated salmon red and quenched in oil. Let a pro do this.

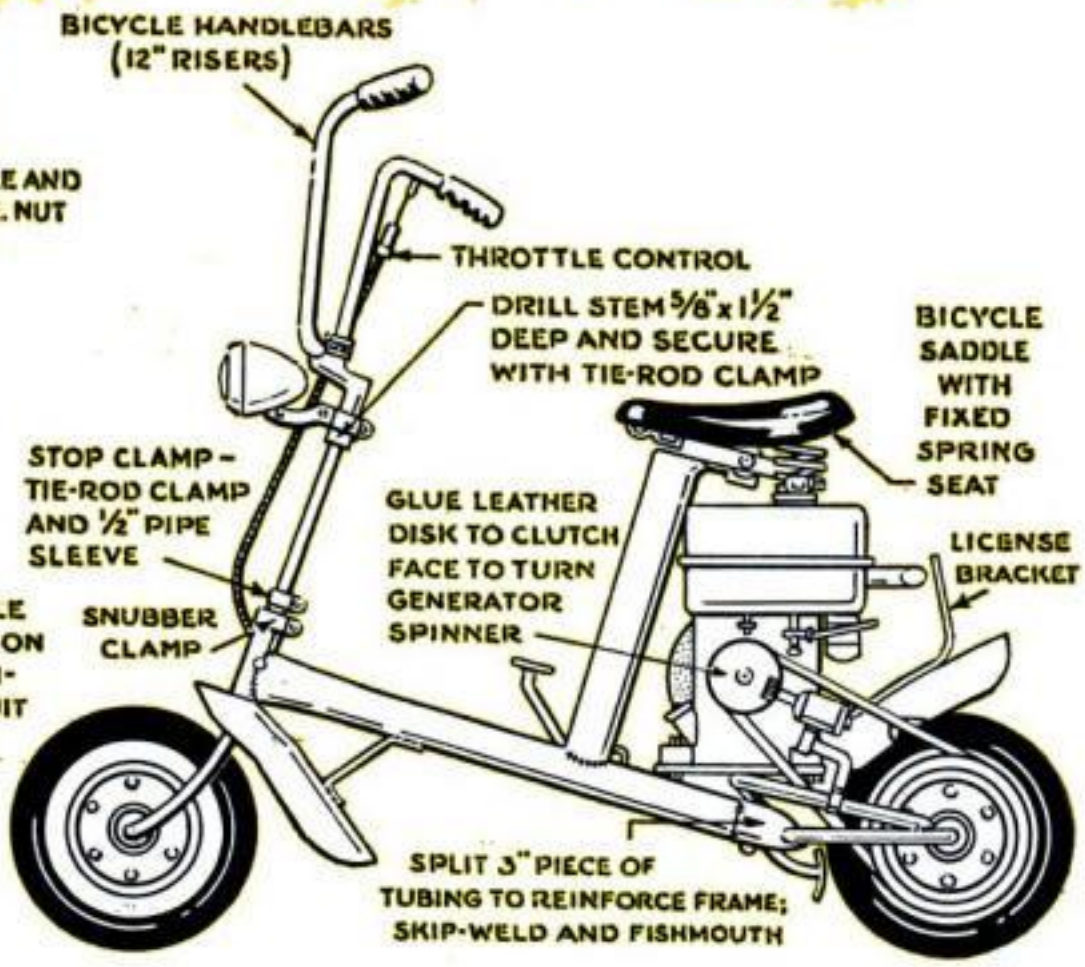
To meet the licensing demands of my state, I've equipped my scooter with a bicycle headlight, tail and stop lights, a bulb-type horn, and a rear-view mirror. Juice for the lights is supplied by a generator set driven by the engine pulley. That way, there's no blackout while I'm idling at an intersection. The stoplight—a 2" Delta tail lamp—is actuated by a brake-pedal-mounted switch made from a set of discarded Ford breaker points (see detail drawing). I have also placed a 4" truck-type reflector on the Popcycle's posterior. ■ ■

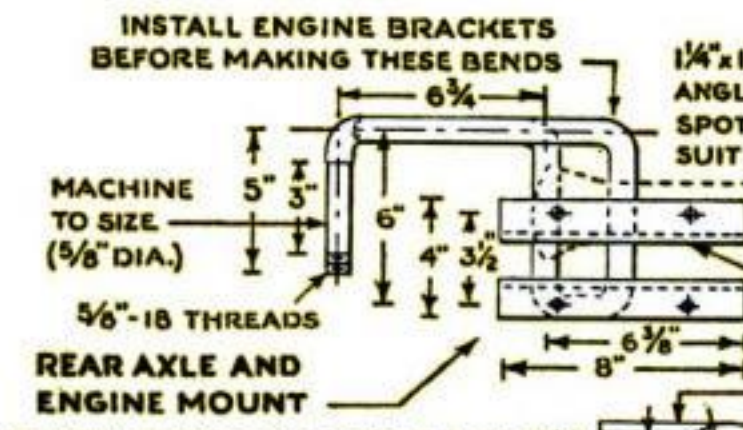
Completely detailed plans, welding data, and a parts list for building the Popcycle are available for $2. Address J. M. McBride at 2631 Kensington Way, Stockton 4, Calif.

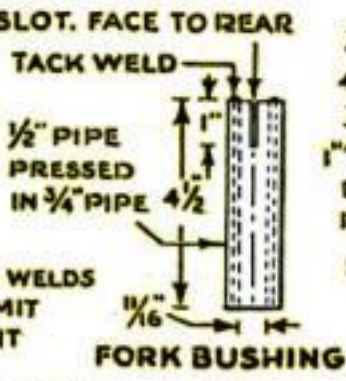

REWIND STARTER
(IF IN POSITION SHOWN, REMOUNT WITH HANDLE AT REAR)
MAKE PAPER PATTERN AND DRILL TANK BRACKET TO MATCH THESE 3 BOLT HEADS
NEW HOLES
CUT HERE AND WELD TO OTHER TAB IF NEEDED
TYPICAL BRACKET REWORK TO MOVE TANK TO SHAFT SIDE OF ENGINE FOR CLEARANCE

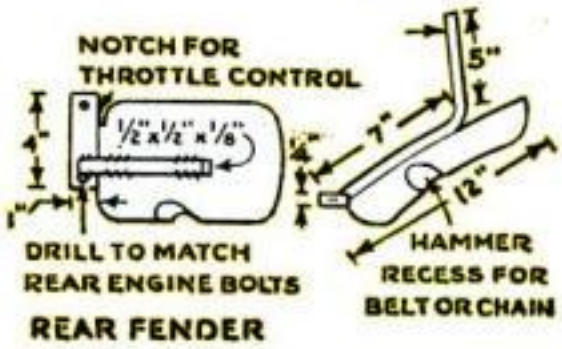
Urheberrechtlich geschütztes Material

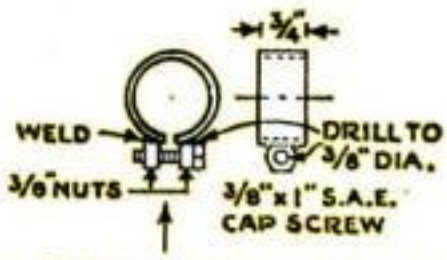

BRAZE FORD CARBURETOR ARM
4"
3/4"
3/4"
DRILL HOLE AND BRAZE 1/2" S.A.E. NUT
BRAZE 1/2" x 2" S.A.E. SCREW CAP
10 1/2"
IF SPEEDOMETER CONDUIT HAS GUARD SPRING, PLACE UNDER HOSE CLAMP
AUTO SPEEDOMETER CABLE
HANDLEBAR REWORK
FORD CARB. QUICK DISCONNECT
SLOT ROD AND SOLDER TO SPEEDOMETER CABLE
SOLDER THROTTLE HOOK (3/32" ROD) ON AFTER CABLE IS INSERTED IN CONDUIT
2"
5 1/2"
1 1/2"
MAKE CABLE 2" LONGER THAN CONDUIT
SOLDER 5/16" TUBE (GAS LINE) IN END OF CONDUIT
59" ±
2 1/2"
THROTTLE CONTROL

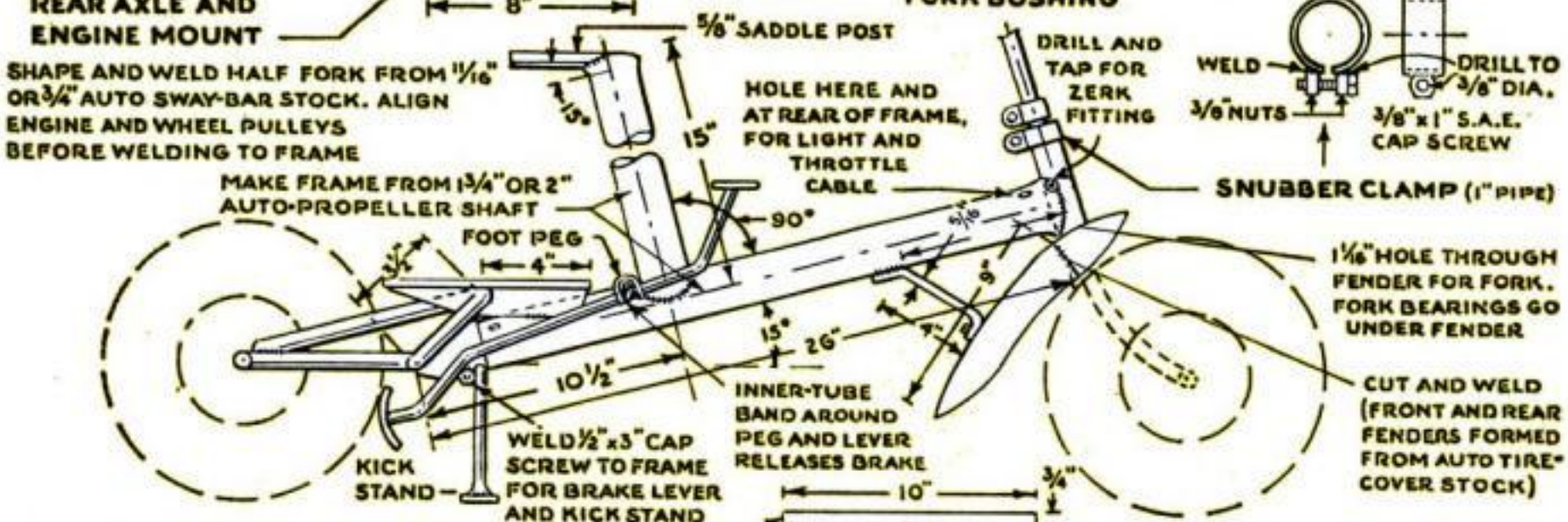

BICYCLE HANDLEBARS (12" RISERS)
THROTTLE CONTROL
DRILL STEM 5/8" x 1 1/2" DEEP AND SECURE WITH TIE-ROD CLAMP
BICYCLE SADDLE WITH FIXED SPRING SEAT
STOP CLAMP – TIE-ROD CLAMP AND 1/2" PIPE SLEEVE
GLUE LEATHER DISK TO CLUTCH FACE TO TURN GENERATOR SPINNER
LICENSE BRACKET
SNUBBER CLAMP
SPLIT 3" PIECE OF TUBING TO REINFORCE FRAME; SKIP-WELD AND FISHMOUTH

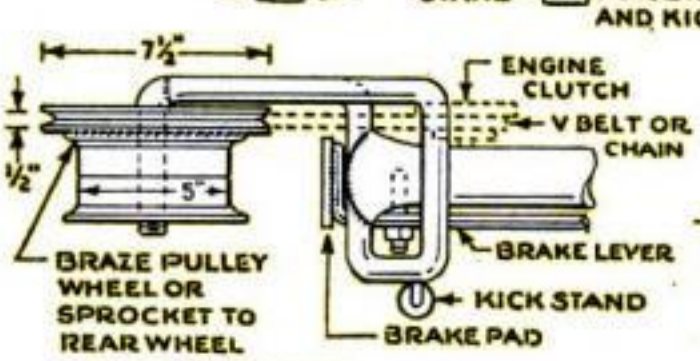


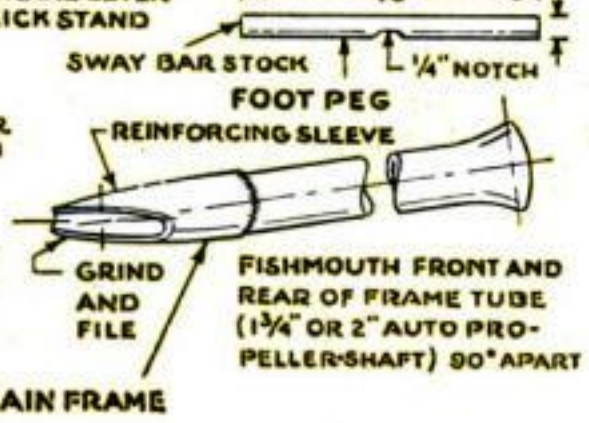


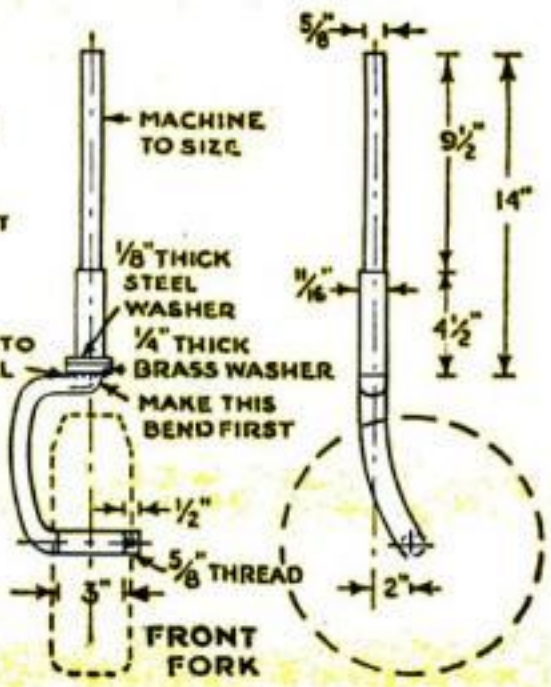


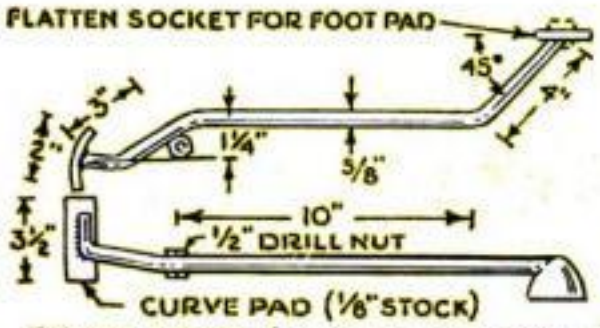


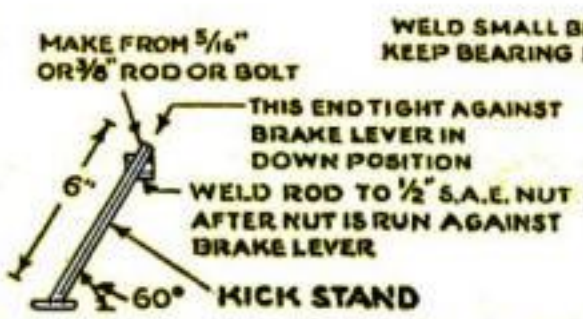

5/8" SADDLE POST
SHAPE AND WELD HALF FORK FROM 11/16" OR 3/4" AUTO SWAY-BAR STOCK. ALIGN ENGINE AND WHEEL PULLEYS BEFORE WELDING TO FRAME
7 1/2"
15"
HOLE HERE AND AT REAR OF FRAME, FOR LIGHT AND THROTTLE CABLE
DRILL AND TAP FOR ZERK FITTING
MAKE FRAME FROM 1 3/4" OR 2" AUTO-PROPELLER SHAFT
90°
FOOT PEG
4"
2 1/2"
15°
26"
10 1/2"
INNER-TUBE BAND AROUND PEG AND LEVER RELEASES BRAKE
WELD 1/2" x 3" CAP SCREW TO FRAME FOR BRAKE LEVER AND KICK STAND
KICK STAND
1 1/16" HOLE THROUGH FENDER FOR FORK. FORK BEARINGS GO UNDER FENDER
CUT AND WELD (FRONT AND REAR FENDERS FORMED FROM AUTO TIRE-COVER STOCK)
10"
3/4"
SWAY BAR STOCK
1/4" NOTCH
FOOT PEG




REINFORCING SLEEVE
GRIND AND FILE
FISHMOUTH FRONT AND REAR OF FRAME TUBE (1 3/4" OR 2" AUTO PROPELLER-SHAFT) 90° APART
MAIN FRAME






MAKE FROM 5/16" OR 3/8" ROD OR BOLT
THIS END TIGHT AGAINST BRAKE LEVER IN DOWN POSITION
6"
WELD ROD TO 1/2" S.A.E. NUT AFTER NUT IS RUN AGAINST BRAKE LEVER
60°
KICK STAND

Urheberrechtlich geschütztes Material

Gus Finds a Cure for the

Flat on his back with flu, Gus still couldn't quit wondering why Doc Barnes' car was smoking like a chimney on four wheels

By Martin Bunn

"DR. BEN Casey, I presume?" Gus Wilson looked up from the engine he was checking with a stethoscope and listening rod.

"Doc Barnes!" he called out as he killed the engine. "What did you say, Doc?"

"I mistook you for that handsome doctor on TV, Gus. Never saw a mechanic use a stethoscope before."

"We have to with these modern engines. They're so complex that we need the 'scope to distinguish one noise from another."

"There *is* a lot more under the hood now than there was in the days when I drove a Model T," the doctor said with a laugh.

"A lot more to go bad, too," Gus said ruefully. "And when you get a customer like Karl Schmidt . . ."

"Thought I recognized the brand-new look that Karl manages to keep in his cars. Can't be much wrong with it, can there?"

"Nothing serious. But somehow I just can't nail it down. Between the buzzing in my head and . . ."

The Model Garage owner realized that the physician was watching him closely, with a professional look on his face. "What brings you in today, Doc?" he asked abruptly.

The question was ignored. "Had the bug for a couple of weeks now, haven't you, Gus? Did you get those flu shots I suggested last summer?"

Gus shook his head. "Never got around to it. But I'll be okay in a day or so. Now what's wrong with your car?"

Doc explained that a large cloud of white-blue smoke poured from the exhaust of his Rambler Ambassador when he slowed up and came down the ramp after a fast run on the turnpike. First there would be a "death rattle," then the smoke.

"Probably just burning a little oil," Gus said. "Your engine's never been overhauled, has it?"

Doc Barnes shook his head in disagreement. "Can't be burning oil," he said. "I usually put a pint of additive in the crankcase about 1,500 miles after every oil change, and it's been 1,800 miles now since I changed oil and the oil's still on the Full mark on the dipstick. The book says you shouldn't go over the Full mark on these Ambassadors."

"Can't always go by the book, Doc."

"I suppose not. But look here, Gus—this new type of Asian flu is almost epidemic in the eastern part of the state. Weren't you hunting around Sutton not long ago?"

Gus readjusted his stethoscope, started the engine, and said, "You take my car, Doc. Stan will run yours over after he's checked it. I promised to finish this job as soon as possible."

When Stan arrived a short time later, Gus put him to work on the Ambassador after repeating the physician's story. Gus finally found that the engine noise on Karl Schmidt's car came from excessive valve clearance, which he adjusted. Why had he taken so much time on a job that should have been diagnosed and cured in a few minutes? His head still buzzed, he was a little dizzy. He couldn't shake it off. Maybe Doc Barnes had something. When Stan came back after a road test in the Ambassador, Gus was stretched out in his office, feet on the desk.

"Nothing serious, Boss," Stan reported. "That new kid at Hank Billings' service station probably put a quart of oil in the crankcase when it didn't need it. It's up over the Full mark."

Gus grunted.

"The extra oil probably spilled over and was sucked into the valves, giving off a

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Doctor's Car

"Never saw a mechanic use a stethoscope before," Doc Barnes said. "We have to with these modern engines," replied Gus.

puff of smoke. I'll tell Doc about it when I return his car."

Gus grunted again. "When you get back, I'm going home. Feel a little woozy."

For the first time Stan noticed the little beads of perspiration on Gus's brow. "Boss, you're sick. Let me take you home."

"Thanks, Stan, but I'll drive myself home when you get my car back from Doc."

The next morning Gus didn't make it to the Model Garage. Instead, he had a visit from Dr. Barnes.

CONTINUED

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After a brief examination, the doctor asked if he could use the telephone.

"What's the trouble?" Gus asked jokingly. "Forget your tools?"

"Nope—just want to make sure there's room for you in the hospital."

"Hospital!" Gus roared. "I'm too busy to go to the hospital. Just give me some of those new wonder drugs and leave the hospital for people who are *really* sick."

"*You're* really sick, Gus. Let's go."

Stan visited the hospital after work a few days later.

"Doc Barnes is sure stubborn," he told Gus. "His automatic-transmission fluid was

a couple of quarts low—probably because he uses the D-1 button instead of Low and races through the gears when he works his way out of snowdrifts, getting the transmission so hot it just burns up the ATF. But he still insists that there's a connection between the transmission fluid being low and his crankcase oil being high. Has he complained to you?"

"I didn't know that he'd even been to the garage, Stan."

"He's been there, all right. Says he still gets a rattle and smoke after he's been driving fast on the turnpike and makes a right turn coming down the ramp."

"Driving fast—that would thin out the fluid . . ." Gus mused. "Did you check the vacuum line from the transmission solenoid to the manifold to see if the diaphragm was ruptured and if there was any sign of ATF in the tube?"

"Sure. Did that the first thing. There's no sign of ATF anywhere under the chassis, either."

Gus then asked if he had checked the automatic-transmission-fluid cooler lines to the radiator.

Stan had, and added that there was no sign of a leak, nor was there any ATF in the radiator.

Gus nodded wearily. "You're probably right then."

Dr. Barnes wouldn't even discuss the Ambassador with his patient, but Stan brought regular reports. He had drained oil out of the crankcase to get it below the Full mark; he had found the number-one spark plug on the left bank wet. He knew the car was burning oil because the inside of the exhaust was coated with it. He had therefore deduced that the rings were shot, and that the engine needed a major overhaul.

"That all sounds logical," Gus told him. "But you say the automatic-transmission fluid is still going down. Where's it going to?"

Stan was ready to tear his hair out. The marker dye he had put in the transmission had disappeared without a trace. He drained oil from the crankcase and put in an additive and the Ambassador ran like a new car—for a few days. Then *poof!*—a rattle and a cloud of smoke billowed when it came down off the turnpike.

The climax came one night while Stan was visiting his boss, now much improved. The telephone operator asked him to come down to the hospital lobby. Returning a few minutes later, he wore a sickly smile. "Have to run along," he told Gus. "A damsel in distress."

"Don't try to kid me," Gus said. "What's the trouble?"

"Just like I said—heck, Gus, there's no use your getting excited. Doc Barnes was stopped by a trooper on the turnpike because he was creating a road hazard. The car is throwing up a smokescreen like a destroyer. I'm going out with the wrecker and bring him in. I'm sorry, Gus."

"Don't be foolish, Stan. I couldn't have

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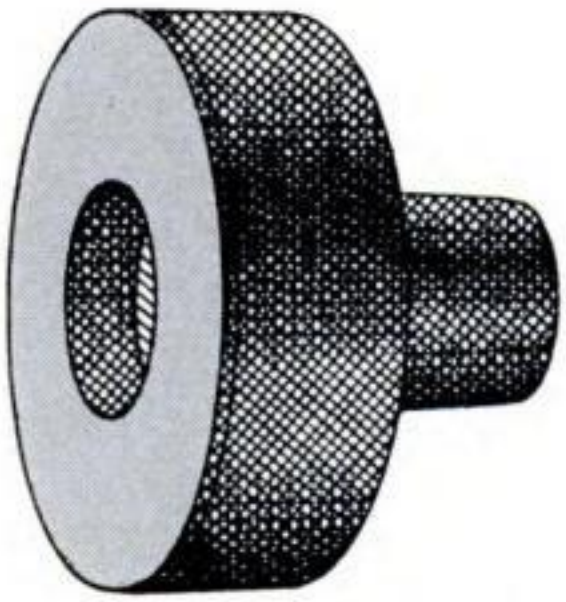
Urheberrecht ch geschützt Maxi al

What does it take to come up with a Ford that rides quieter than a Rolls-Royce?

(In tests certified by the U.S. Auto Club, results showed that a 1965 Ford Galaxie 500 LTD, with the 289-cu. in. V-8 engine and Cruise-O-Matic transmission, rode quieter than a new Rolls-Royce!)

Let's start with something basic—like this 1965 Ford body-to-chassis mount. It doesn't look very different from those used on other cars. The big difference is where these mounts have been positioned by Ford engineers. Through exhaustive testing, Ford engineers have precisely determined the nodal points on the frame of the new 1965 Ford. Nodal points are those places on the frame where vibrations are at a minimum. That's where the body-to-chassis mounts are in the 1965 Ford: where they'll do the most good in reducing road shock, vibration, noise and fatigue.



FORD BODY/CHASSIS "PUCK"

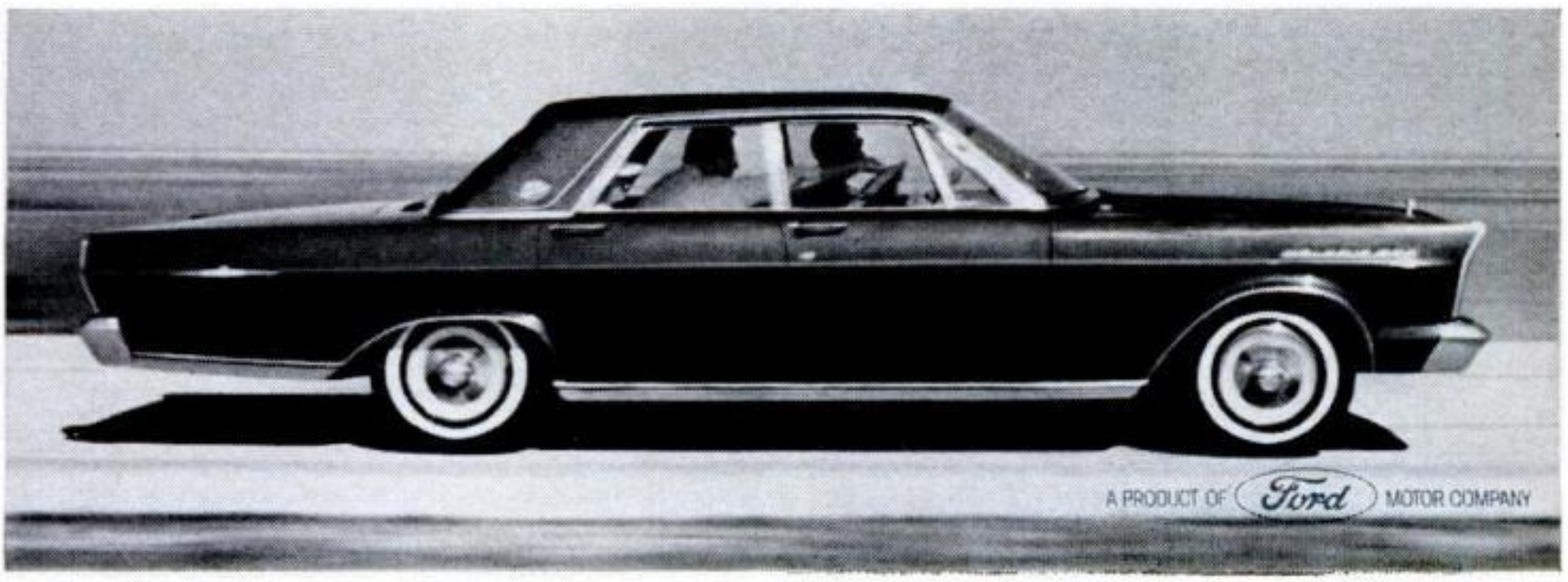
What else? There's an all-new torque-box frame. A body that is the strongest ever built by Ford. All-new coil spring rear suspension. A new, refined version of Ford's famous recessive wheel front suspension that reduces bumps by flexing backward, as well as up and down. And hundreds of other changes, that are improvements, make the 1965 Ford stronger, quieter and better riding. That's why we say that 1965 is the best year yet to go Ford.

See your Ford Dealer. Take a test drive. Try Total Performance '65!

Best year yet to go Ford!
Test Drive Total Performance '65

FORD

MUSTANG · FALCON · FAIRLANE
FORD · THUNDERBIRD



THE TOTAL PERFORMANCE FORD GALAXIE 500 LTD 4-DOOR HARDTOP

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done any more than you have. Give Doc my car and tell him to drive it until we return his car—cured of smoking!"

Long after the lights were out that night, Gus Wilson's mind pictured the underside of the Ambassador. It was up on the lift. The front end of the transmission ran into a steel wall at the flywheel. The rear end, joining the torque tube, had a drain hole that would disclose any loss of automatic-transmission fluid. The solenoid and its vacuum tube had been thoroughly checked. Only the transmission cooler lines to and from the lower radiator were left as possible suspects, but any leak in those steel pipes would have been vividly marked by the dye. Where was the stuff going to?

The Ambassador was air-conditioned, but there was no possible connection. Power steering? ATF was used in its system, but again there was no connection to the transmission, and the reservoir level had remained constant. Power brakes? Being the atmospheric-pressure type, there was a vacuum connection to the intake manifold through a vacuum check valve and a vacuum reservoir. But there had never been any change in the level of the brake fluid, or evidence of the dye marker being sucked in . . .

Sucked in! The words lit up like a neon sign in his brain. He mentally raced again along the underside of the Ambassador. He had it! Grinning broadly, he settled back to enjoy his best sleep in a month.

Dr. Barnes found his patient bright-eyed and smiling the next morning. "Gus, you really look good. You should be able to leave any day now."

"I'm ready to leave right now, Doc, and I want my car!"

"You're kidding. You gave me the use of your car until mine was fixed. Don't tell me Stan fixed it last night."

"Not last night. This morning. He couldn't sleep, so he was in the garage at six. Had your car ready to go at seven."

Doc stared. "What was wrong?"

"Your transmission cooler lines have been sitting on top of your power-brake reservoir for a long time. The two surfaces ground away at each other, until there was a tiny crack common to each. Then, because there's 85 pounds' pressure per square inch on the cooler lines, and a vacuum of about 18 inches in the reservoir, the two worked together, transferring the fluid from one to the other without spilling a drop. When you drove fast on the turnpike, the fluid got hot and thin, and gushed into the reservoir, up the brake line, and into the intake manifold. When you left the turnpike, driving down the ramp to the right, centrifugal force carried the fluid to the number-one cylinder on the left. It was sucked into the valve. Some went into the combustion chamber and came out as smoke—the rest dripped into the crankcase, raising the oil level."

Doc had listened intently. "And last night," he said, "the holes got big enough to permit a continuous flow, producing a smoke screen. But what about the rattle?"

"Elementary, my dear Doctor. The fluid that burned in the combustion chamber lowered the octane rating of the gas, causing a bad knock."

Dr. Barnes gave his patient a quizzical look. "I'm sure Stan didn't figure all that out by himself. *You* must have solved this case right here, flat on your back. You know," he said, turning Gus's head so he could see his profile, "there *is* a resemblance. And Ben Casey solves all his tough cases in a general hospital, too!" ■ ■

Rear engine drives car-like tractor

Designed to work hillside vineyards, this baby tractor has a car-type plastic body that seats two. Wide-tracked, the 1,880-pound machine was built in Czechoslovakia. It has front power takeoff and hydraulic linkage for handling a mower or other farm implements. A 10-hp. diesel under the tail deck drives dual rear wheels. A versatile gearbox has four speeds in both directions.

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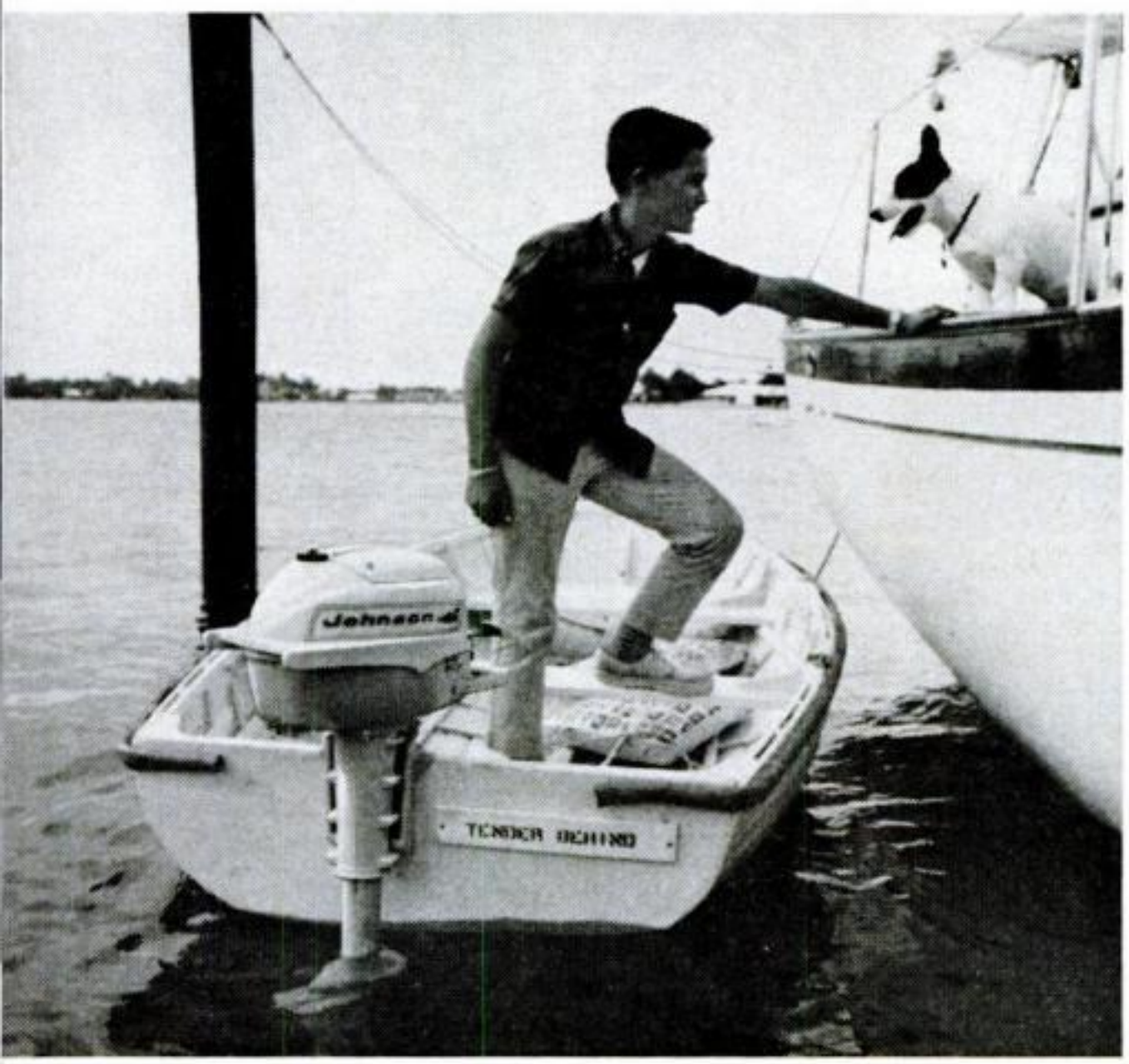
Looking for a little outboard that's not afraid of work or weeds or salt water, one that's surprisingly strong and with a warranty surprisingly long?

Solution:
the carefree, new 3 *(a Sea-Horse, of course!)*



Actually there are two new Johnson 3's. One is the High Thrust 3—a new right angle drive plus a 3-bladed prop allow it to deliver 24% more static thrust. (As an accessory, an additional 15" lower unit extension is available.) The other is the Angle-Matic 3— with its weedless prop and sloping skeg it knifes through weeds that would stop an ordinary outboard.

One hour's cruising costs about 15¢. Either Sea-Horse 3 burns less than 3 pints of fuel per hour! What kind of fuel? Nothing exotic. Regular grade gasoline and oil. Fact is all 17 new Johnsons do, from the 3 hp to the 90 hp Golden Meteor. And any one of them will halve your oil costs because each now uses a new 50 to 1 gas-oil mix.

Complete corrosion protection. No Johnson needs flushing after salt water use. All are quiet as the night and dependable as sunrise. All are backed by a 2-year warranty* on parts and labor. For the right engine to fit your needs, see your Johnson dealer. He's listed in the Yellow Pages. Johnson Motors, 1945 Pershing Rd., Waukegan, Illinois. Division Outboard Marine Corporation. In Canada: Johnson Motors, Peterborough, Ontario.

*For 24 months after purchase, Johnson Motors will replace without cost to the original purchaser, any part of its manufacture which upon inspection proves to have failed in normal use due to faulty material or workmanship.

Another carefree Johnson ...first in dependability

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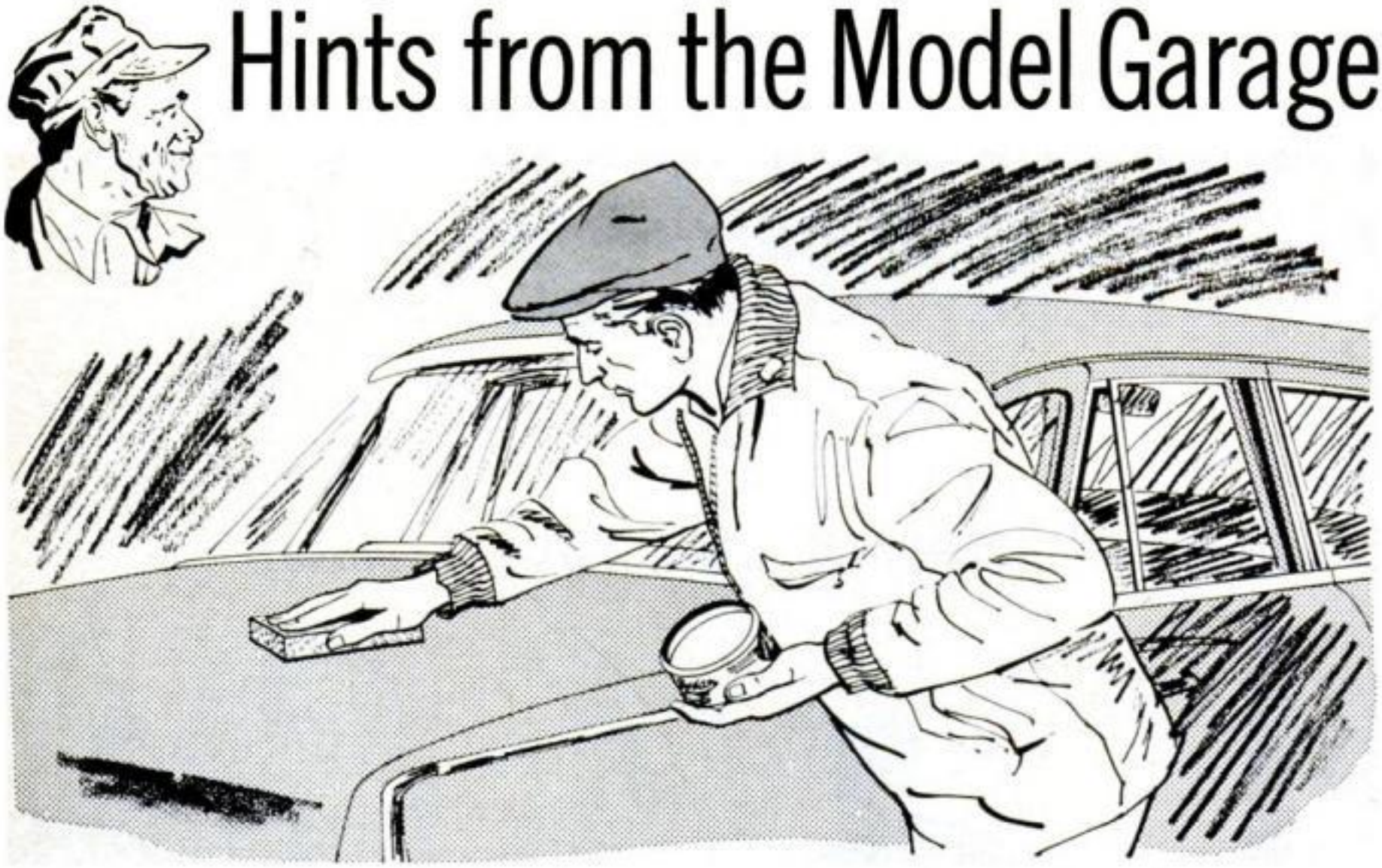
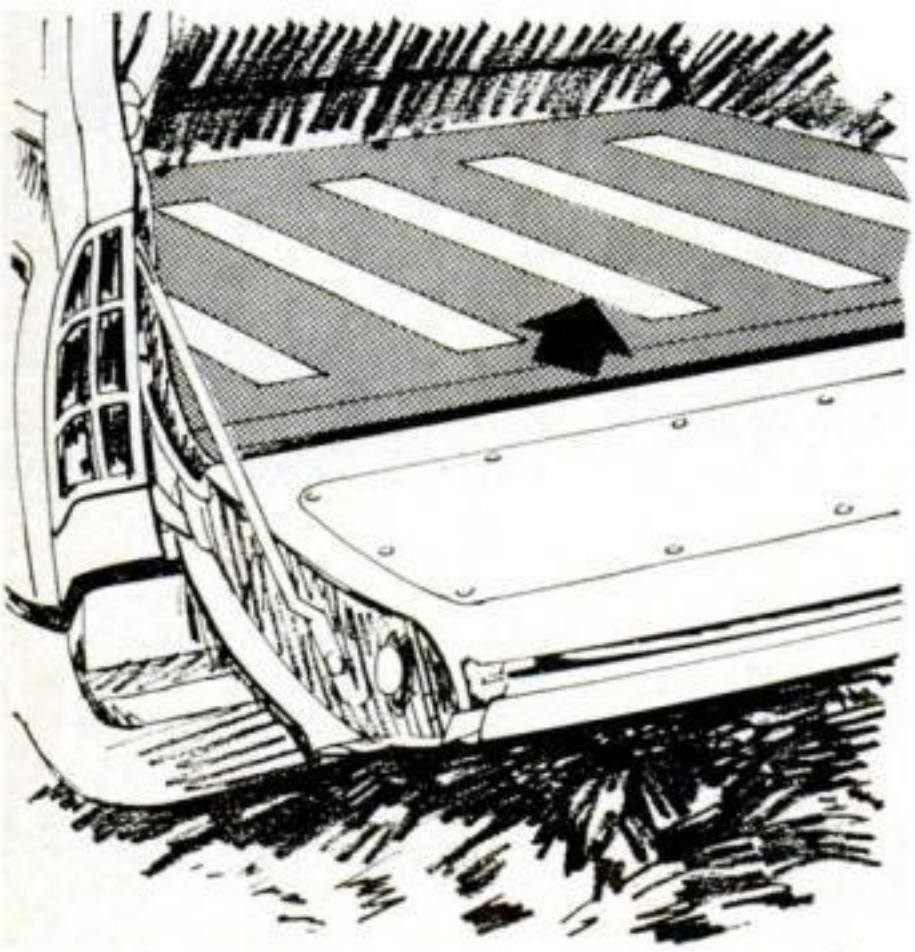
Hints from the Model Garage



The secret of a smooth wax job with paste wax is to apply the stuff uniformly. It's easy if you use a sponge as an applicator—either cellulose or natural sponge is okay. Soften the sponge by soaking it in water, but squeeze out all excess water before using it. For faster waxing, choose a coarse-grained sponge of the type sold for household cleaning. Its large holes will fill with a supply of wax, so that one trip to the wax can will cover several square feet of metal. Store the sponge in the wax can.



To prevent loads from shifting on the smooth metal rear deck of a station wagon, apply strips of adhesive-backed antiskid tape. This material is sold in hardware stores to provide an antiskid surface in bathtubs and on stone steps.

Keep windshield-wiper blades "alive" longer by coating them with silicon slick spray from an aerosol can. The slippery coating reduces friction between blade and windshield, prolonging blade life and greatly improving their water-wiping efficiency.

CONTINUED

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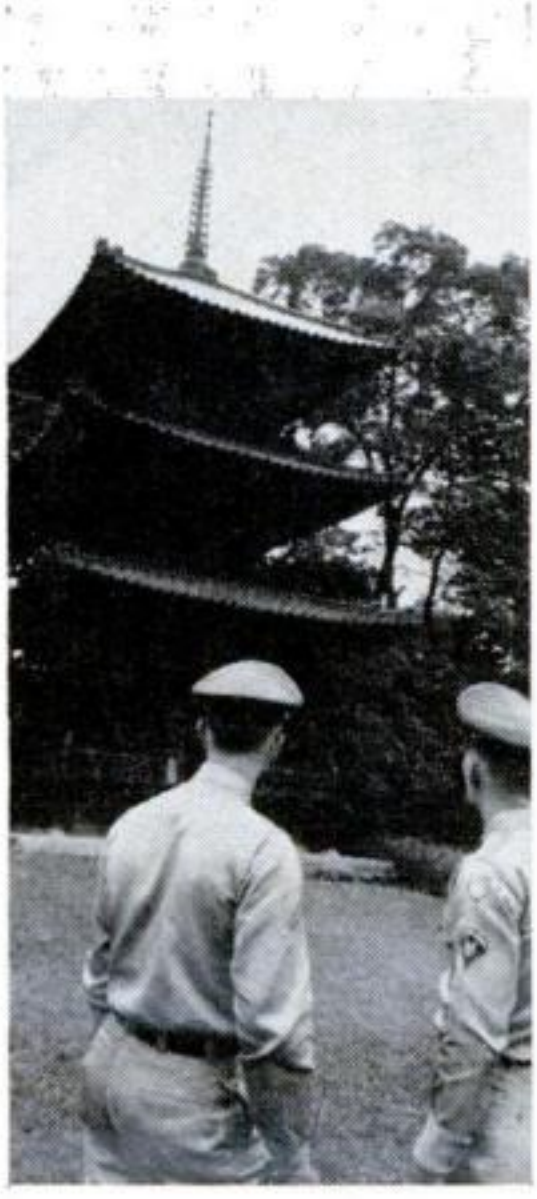
Share great moments with other great guys

Get a new set of wheels in the Army. Ten feet across or scooter size, there are more wheels in the Army than in any other organization in the Free World. Some are an adventure to drive, others take you to adventure—and, if you want, you can learn what makes each one roll.

Experts are made, not born. And the Army makes the best. Army schools teach hundreds of different specialties. If you qualify, you can sign up for the one you want before you enlist.

It's different from your home town. And who wouldn't expect it to be? After all, one of the reasons you join the Army is to see the world of differences.



You're not alone in today's action Army. Every experience you have is shared with other great guys. Regular guys who are learning, earning, growing, going, serving our Country, developing themselves. Just as you are.

But the wonder of these experiences is yours alone. No one can tell you how great it feels to master a difficult specialty like computer programming, missile repair, electronics, or construction. No one can live the excitement of landing in a foreign country for you. No one can know what *your* great moments in the Army will be. But you can be sure your life in today's Army will be full of great moments. Enough to add up to a great life.

Talk to your local Army recruiter. Let him tell you what the Army can do for you... and what you can do for the Army. Let him help you to that great moment, the moment you realize that...if you're good enough to get in, a proud future can be yours in today's *action* **Army**

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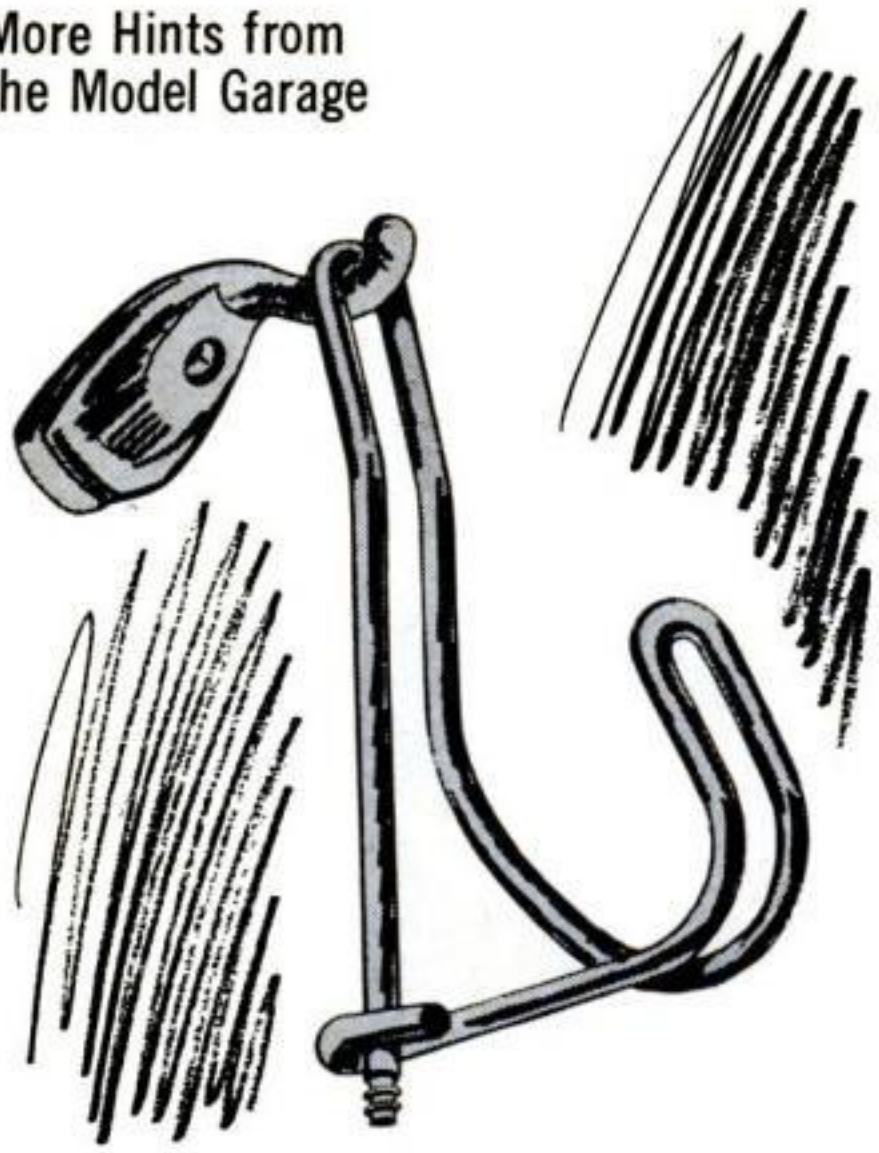
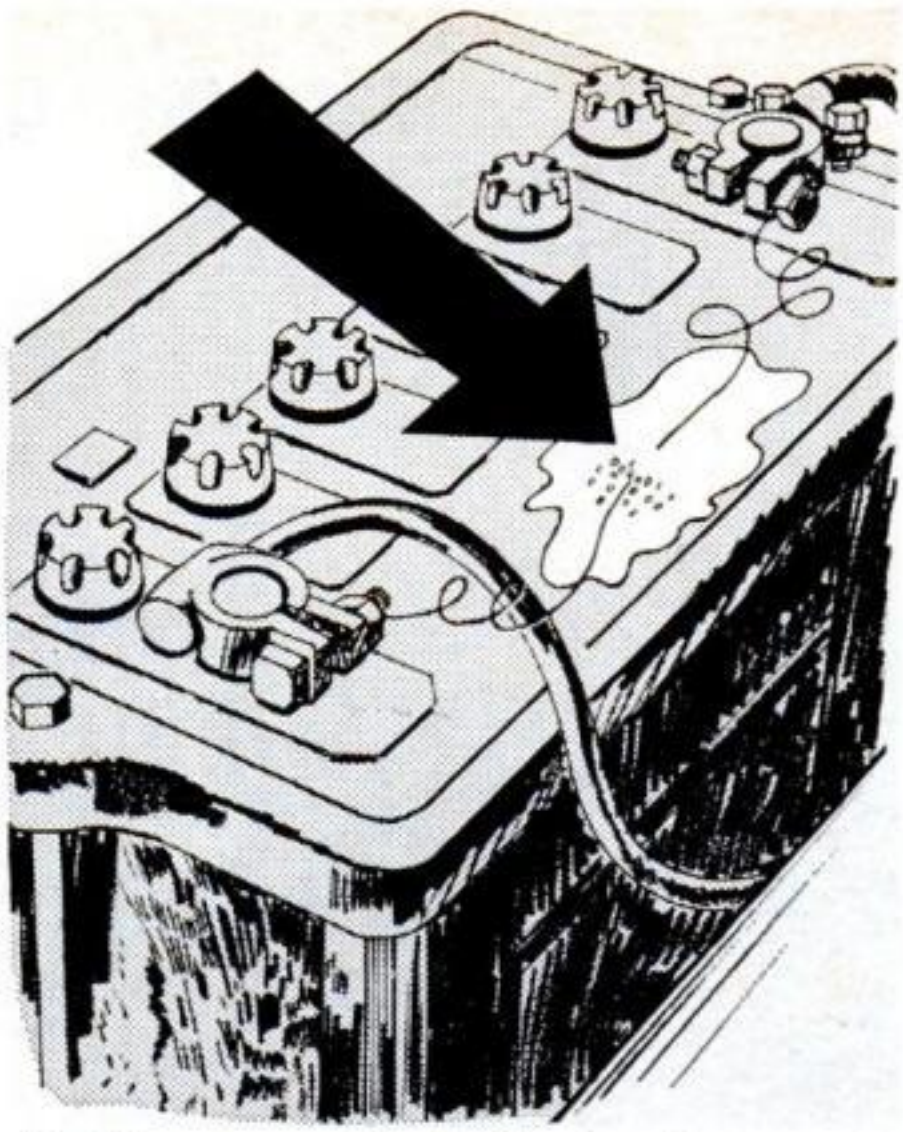
More Hints from the Model Garage



Make a trip-sized back-seat coat hanger for your car by slipping a heavy wire screw-in coat hook over the car's built-in hook. You can buy the wire coat hook in any hardware store. It's strong enough to hold several hangers laden with clothing.



Positive or negative? Here's a fast way to identify the terminals of your battery if the markings are worn off: Dip the ends of two wires connected to the terminals into a small pool of electrolyte. Bubbles will form at the negative lead's tip.

Changing an oil filter won't be such a dirty chore if you wrap a plastic bag around the filter housing before removing the retaining bolt. The same trick works with spin-off filters: Slip the bag over the filter before fitting the strap wrench.

A car's dome light can be used at night by back-seat passengers without disturbing the driver, if you install a cardboard shield. Wedge the bent edge between the light and the headliner. Position it so it casts a shadow over the driver's area.

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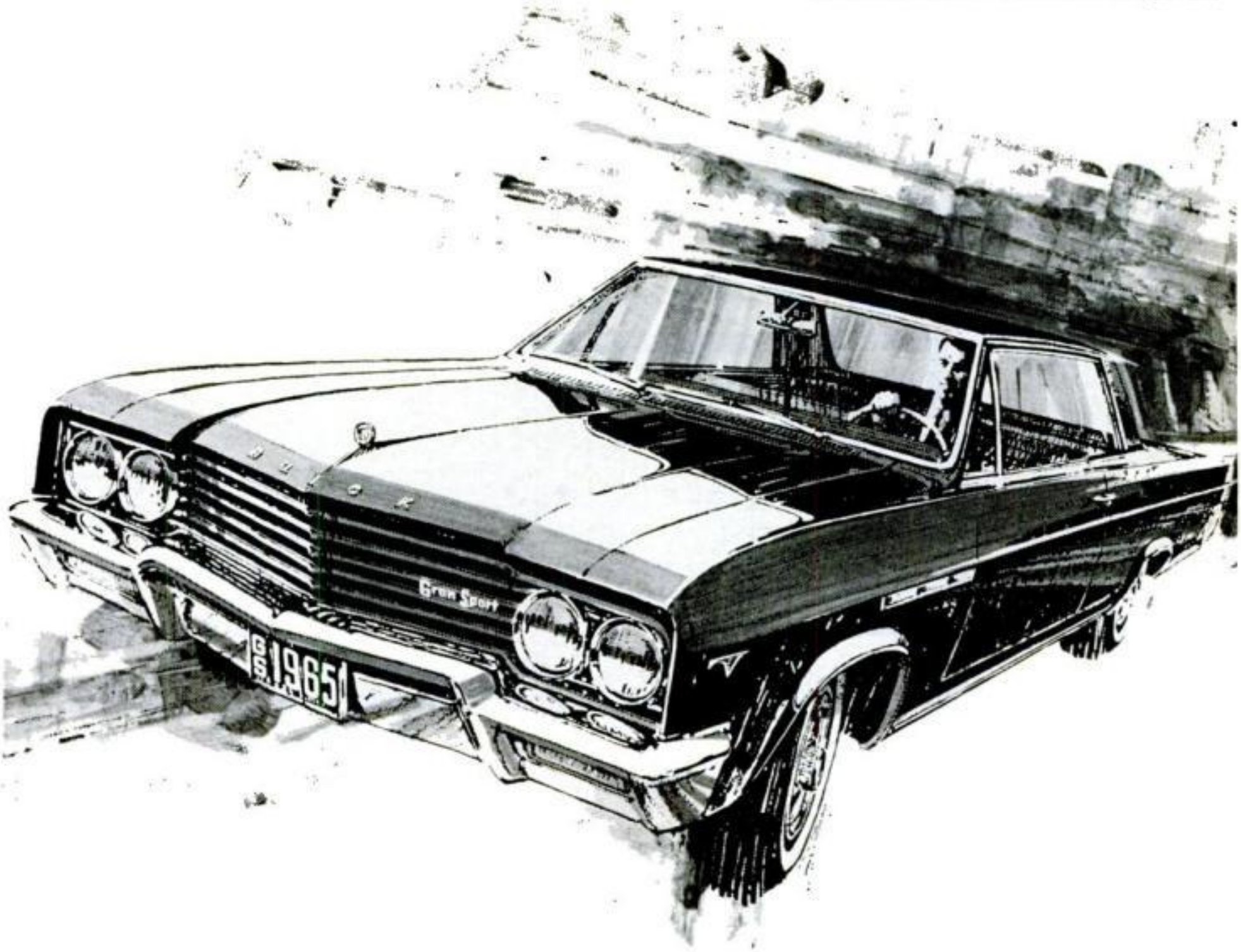

A howitzer with windshield wipers. The new Buick Skylark Gran Sport. 400 cu. in./325 bhp.

There is mounting evidence that our engineers have turned into a bunch of performance enthusiasts.

First they stuff the Wildcat full of engine. Then the Riviera Gran Sport. And now this, the Skylark GS, which is almost like having your own, personal-type nuclear deterrent. We've just turned it loose on our dealers. (See the Buick dealers run.)

Aside from all those cubic inches and horses and 445 lb-ft of torque, just what is this thing that our engineers have unleashed?

It's a pretty sophisticated suspension package, for one thing: Heavy-duty springs and shocks, plus a stabilizer bar that's about twice as stiff as the normal Skylark's. Axle wind-up is snubbed by heavy-duty upper control arm bushings.

It's also a floor-shift 3-speed, with all forward gears synchronized. Dual exhausts. A reinforced convertible frame to handle all that extra torque. 7.75x14 tires. All standard equipment.

Want to go the 4-speed route? There's a close-ratio unit available. Axle ratios? They read like this—2.78, 3.08, 3.23, 3.36, 3.55, and 3.73:1.

Well, there's some of the evidence. Performance enthusiasts, that's what they are.

More power to them.

The Buick Skylark **Gran Sport**

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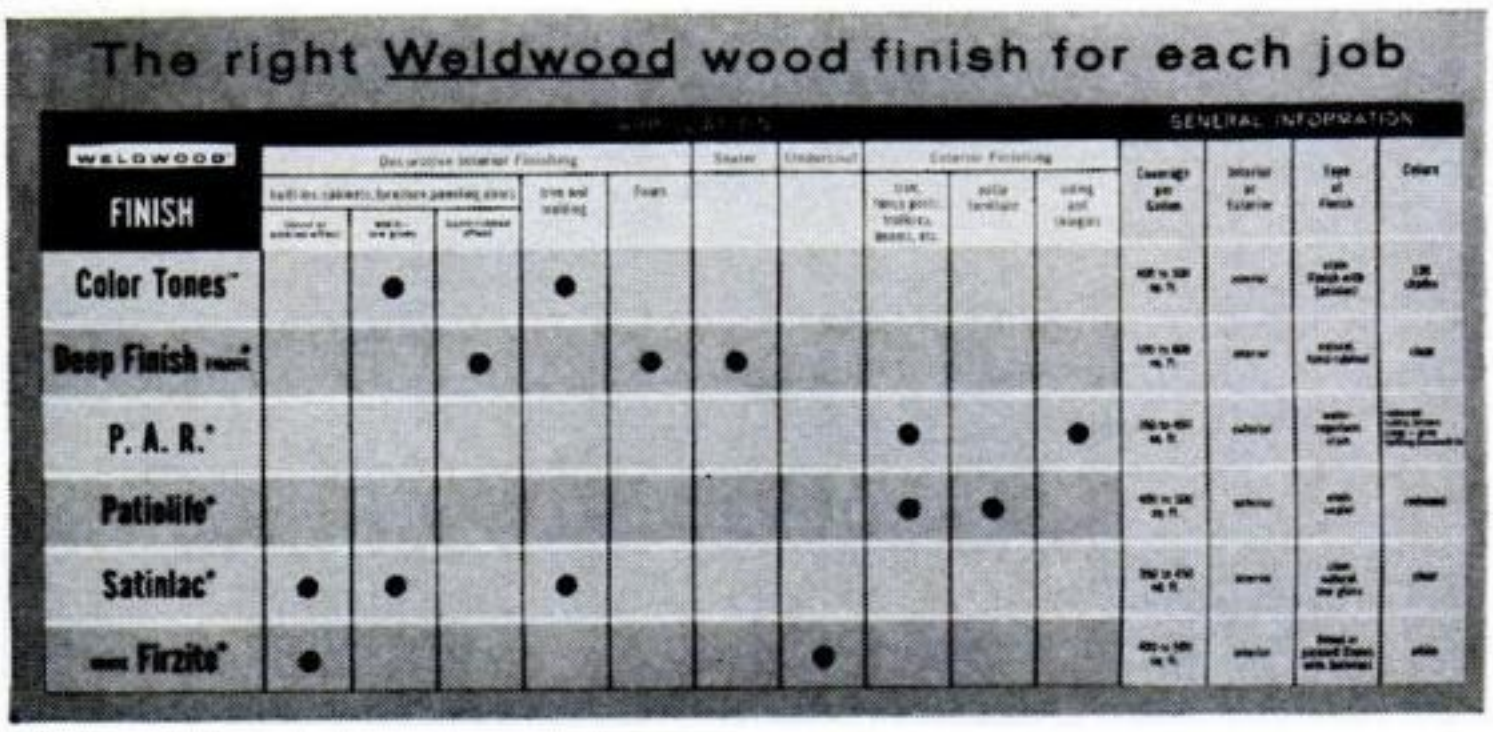
Get the last word on finishes.

Send for this new wood finishing guide— free from Weldwood, the people who know wood best.



Weldwood Deep Finish Firzite® gives furniture a rich "hand-rubbed" oil finish—without the hand rubbing. Protects, beautifies floors.

Weldwood Satinlac® for greater gloss than Firzite without a heavy "built-up" look. Contains ultraviolet absorber to inhibit yellowing.

Weldwood P.A.R.® penetrating exterior water repellent stain finish for sidings, fences. Guards against checking, can't blister. 5 colors.

Weldwood Patiolife® water repellent stain finish for outdoor furniture, decks. Its satin redwood color limits rub off.

Weldwood Woodlife®, the original water repellent wood preservative. Stops rot, fungus; retards warping, checking; kills termites.

Weldwood Color Tones™, a precision stain system for matching trim and molding to wood paneling. Color chips of 138 shades simplify color-matching.

WELDWOOD® Wood Finishes

Write for free wood finishes guide:
United States Plywood,
Dept. PSM 3-65, Protection Products Division,
2305 Superior Avenue, Kalamazoo, Michigan

Come see us at the 1965 World's Fair—Better Living Building.

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Wordless Workshop

By Roy Doty

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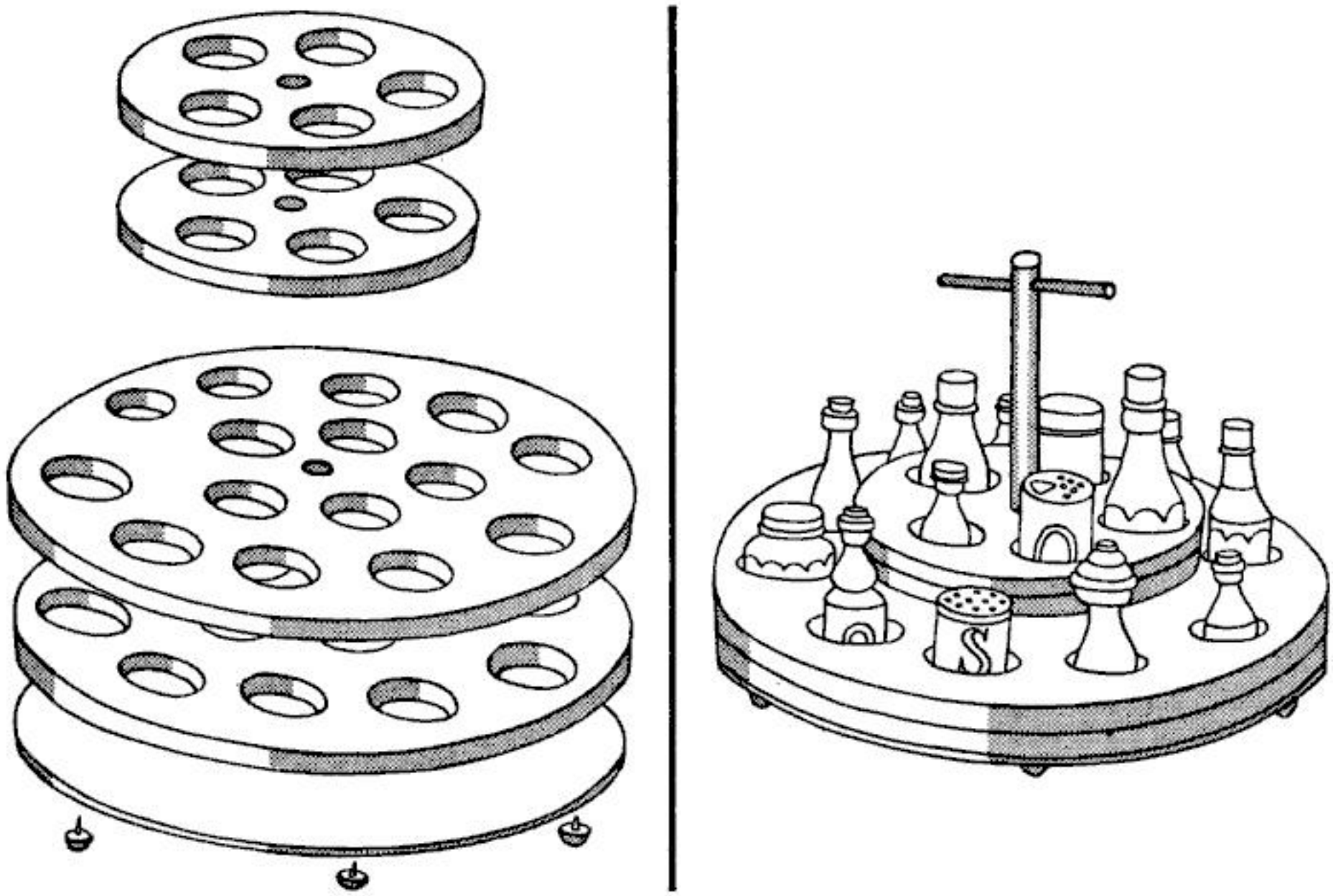
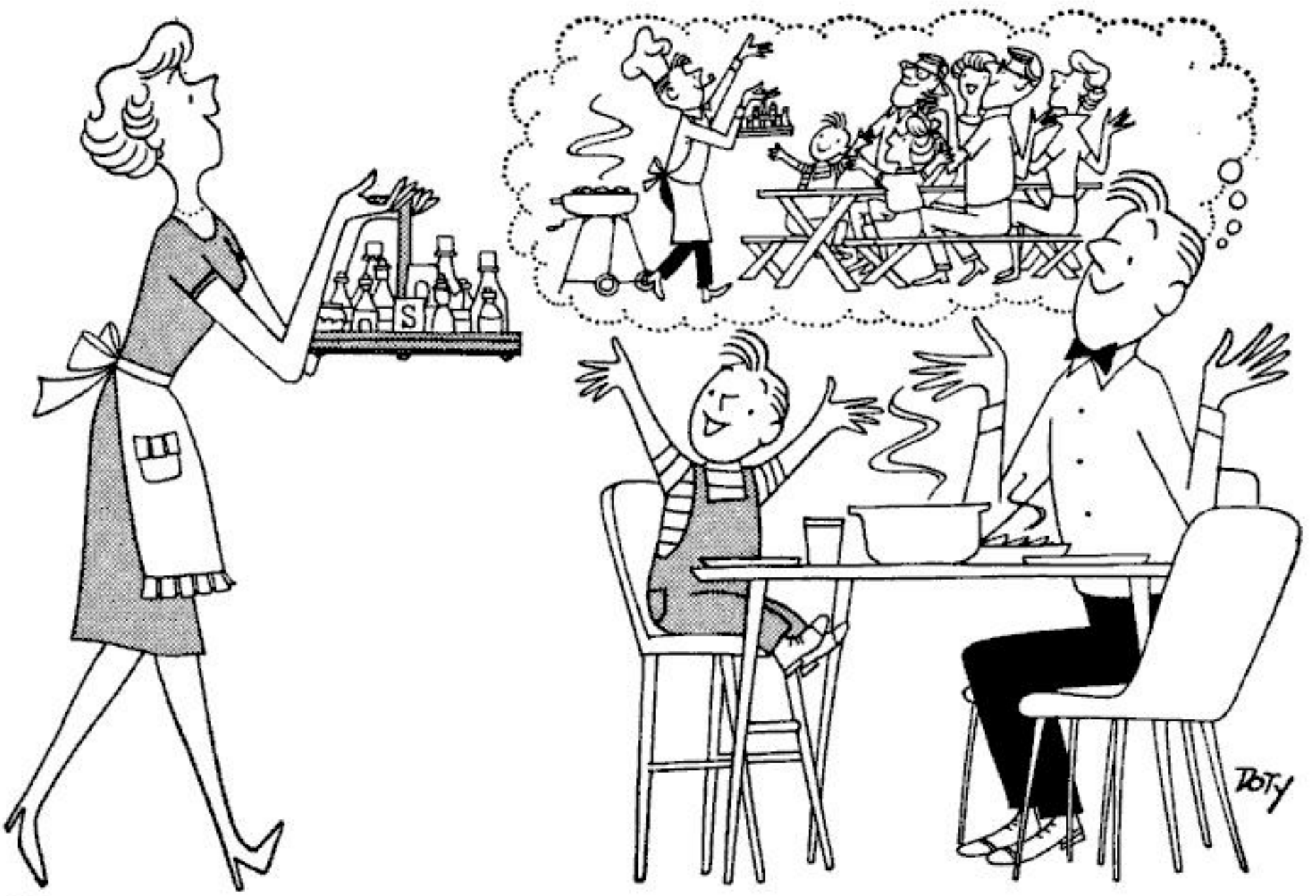
Wordless Workshop continued





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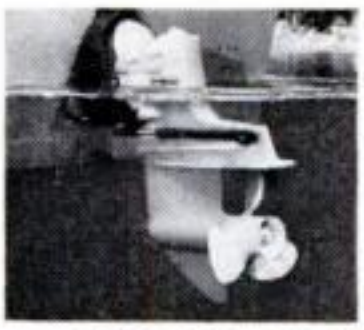
PHOTOGRAPHED UNDERWATER AT FLORIDA'S SILVER SPRINGS

What has the propulsion efficiency of an outboard and the fuel economy of an inboard?



MerCruiser Stern Drive: A MerCruiser is the most efficient underwater unit you can buy. It is more efficient than a conventional inboard because, like an outboard, it applies the propeller thrust directly parallel to the plane of motion instead of downward at an angle. Unlike an inboard, MerCruiser has no fixed shaft, strut, rudder and skeg to cause underwater drag or turbulence around the propeller. MerCruiser's exclusive Jet-Prop also reduces drag by filling the vacuum pocket behind the propeller hub with exhaust gases.

All MerCruisers have economical 4-cycle marine engines that develop high torque at low rpm. There's no need to mix the fuel and oil . . . and they operate quietly and efficiently on regular fuels.

Propulsion efficiency and fuel economy are just two of the reasons to buy MerCruiser. Ask your MerCruiser dealer to show you some others like: the eight MerCruiser engines covering the 60 to 310 hp range . . . MerCruiser's exclusive protection features such as hydraulic shocks, safety tilt, rubber safety clutch, one-piece lower unit housing. Ask him to show you all the reasons why more people buy MerCruiser than all other stern drives combined...60, 110, 120, 150, 190, 225, and 310 hp gasoline; 60 hp diesel.

World-wide Sales and Service

MERCRUISER

STERN DRIVE POWER PACKAGES

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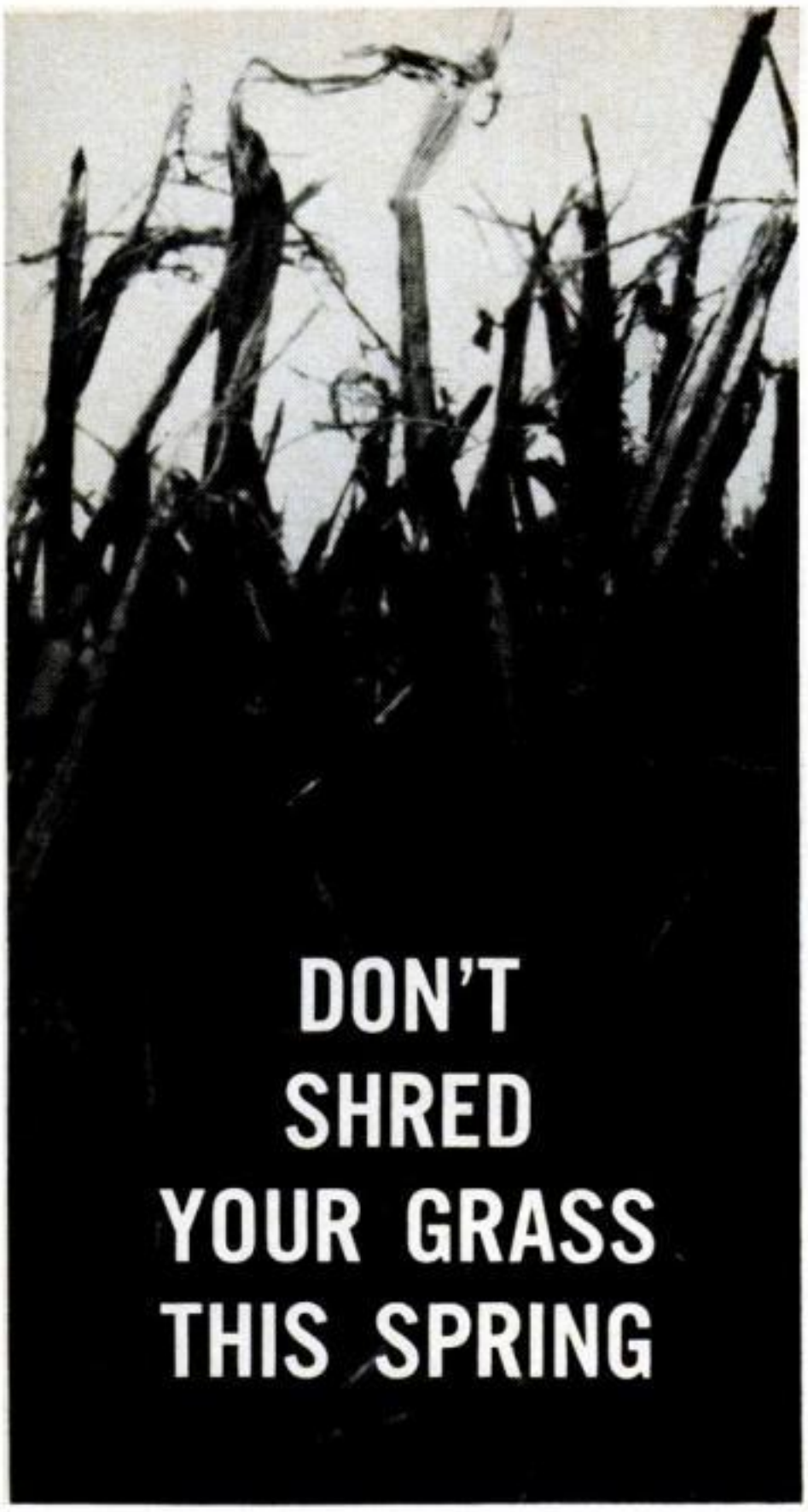

USE THIS NOW!

Dull mower blades tear and shred your grass. But just 5 minutes with a Nicholson or Black Diamond Rotary Mower file now gets your blade ready to cut clean the first time out.

Sharpening your own blade takes far less time and effort than carting the mower to a shop. You're sure of a first-class job if you do it yourself. And the file saves its own cost the very first time you use it. Get one soon at your local hardware store.

Nicholson File Company, Providence, Rhode Island
Files • Rotary Burs • Hacksaw and Band Saw Blades
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When Will We Land on Mars?

[Continued from page 88]

weight of the spaceship for a Mars expedition, fully loaded and ready to go.

For a specific example, let us take a Mars expedition with a crew of eight men, a favorable opportunity such as 1986, a stay on Mars of about 20 days, and "full-speed" aerodynamic re-entry into the earth's atmosphere. We then find:

The departure weight of the all-chemical interplanetary ship will be about 4,000,000 pounds. The figure for the all-nuclear ship will be about 1,600,000 pounds. That is what must be carried up by cargo rockets and assembled in earth orbit.

Let us assume these cargo rockets are outgrowths of Saturn Vs, the most powerful type under development today. Saturn V's earth-to-low-orbit payload capability is about 250,000 pounds—which in due time can probably be stretched to enough more than 330,000 pounds so that three of these advanced Saturn Vs would lug a million pounds of cargo into orbit.

Thus, 12 of the advanced Saturn Vs could haul the weight of the chemical Mars ship into earth orbit—and five of them, the nuclear Mars ship. However, the number of supply flights actually needed may be twice as high, due to the extended duration of the orbital assembly operation—which leads to propellant-evaporation losses and requires assembly-crew rotation.

The figures are high, though not prohibitive. In space, as elsewhere, we must learn to crawl before we can walk—and obviously we have a lot to learn before we can begin to think of mounting a manned interplanetary expedition.

How far along are we?

Launch vehicles and spacecraft for a manned landing on the moon are rapidly approaching reality. Rocket engines and guidance equipment are in an advanced state of ground testing. First parts for flyable stages and spacecraft modules are reaching the assembly floor.

Less than two years from now, a Saturn IB rocket will loft the first manned Apollo spacecraft into earth orbit. Before the end of this decade, if all continues to go well, a huge Saturn V rocket will hurl three astronauts in a similar spacecraft into a trajectory to the moon.

And the launch date for the first manned Mars expedition? Maybe 1986 wouldn't be a bad year, from all angles. ■ ■

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Does your GM car need a part this important?

Take it where you'll get a GM part just like it.

You've got good reasons for doing so.

Because there's hardly anything so important to your family's safety as the way your car's brake linings do their job.

Remember, simply looking at them can't tell you the big difference between unsafe brake linings and linings you can trust.

And simply looking can't tell you the difference between most replacement parts and GM parts just like the originals—designed and tested by the people who built your GM car.

Whenever you need car or truck service, go where you know they use genuine General Motors parts. And wherever you go, insist on genuine General Motors parts. You can find them in most service outlets and just about anywhere you drive in the country. You'll recognize them by their bright new GM and United Delco packages.

GENUINE GENERAL MOTORS PARTS

GM CHEVROLET • PONTIAC • OLDSMOBILE • BUICK • CADILLAC • GMC TRUCKS United Delco

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How to Buy a Projection Screen

[Continued from page 119]

to the screen. If the pattern is 100 lines to the inch, it will be fairly invisible, since the human eye normally does not see things as small as 1/100 of an inch unless it strains to do so.

Because of the glossy reflective nature of the lenticular screen, it must be held flat; the slightest wave or curl is visible as a variation in image brightness. Be sure that the lenticular you buy has an effective tensioning device.

A great advantage of lenticular screens: They can be cleaned easily.

Silver. You may not be able to find a flat silver screen in today's market. Silver had its day in home projection during that brief flurry of "stereo projection," some years back. If you want to show stereo, you can use one of the fine-grain waffle-pattern silver lenticulars.

Your choice, most likely, will be between beaded and lenticular. Some dealers have demonstration cards with these two types plus mat white. You can project an image on the card and get an immediate idea of the differences in color, brilliance, angle of view, etc.

From the standpoint of cost, it goes mat white, beaded, lenticular. The price difference is about one screen size: On average, for the price of a 40″-by-40″ lenticular, you can just about buy a 50″-by-50″ beaded. The biggest cost differential, however, arises from the type of standard that holds the screen.

Choosing a standard. A good standard (mount) for a projection screen protects it from damage when it is out of use and supports it properly during showings. Most of all, it should be convenient.

Half of what you pay for when you buy a screen is the standard, and often the major difference between a cheap screen and a good one is how easy it is to set up. Here are some features to look for:

- Automatic setup. Some standards are literally pushbutton. The screen case swings into position, the tripod legs spread out, and the upright rises—all at a touch of the finger. This helps make showing pictures more enjoyable; you can get the rig out on the spur of the moment and be set up.

You save quite a bit of your screen money if you don't want all the automation. For instance, a 40″-by-40″ in a well-engineered standard costs $35. Eliminate

CONTINUED

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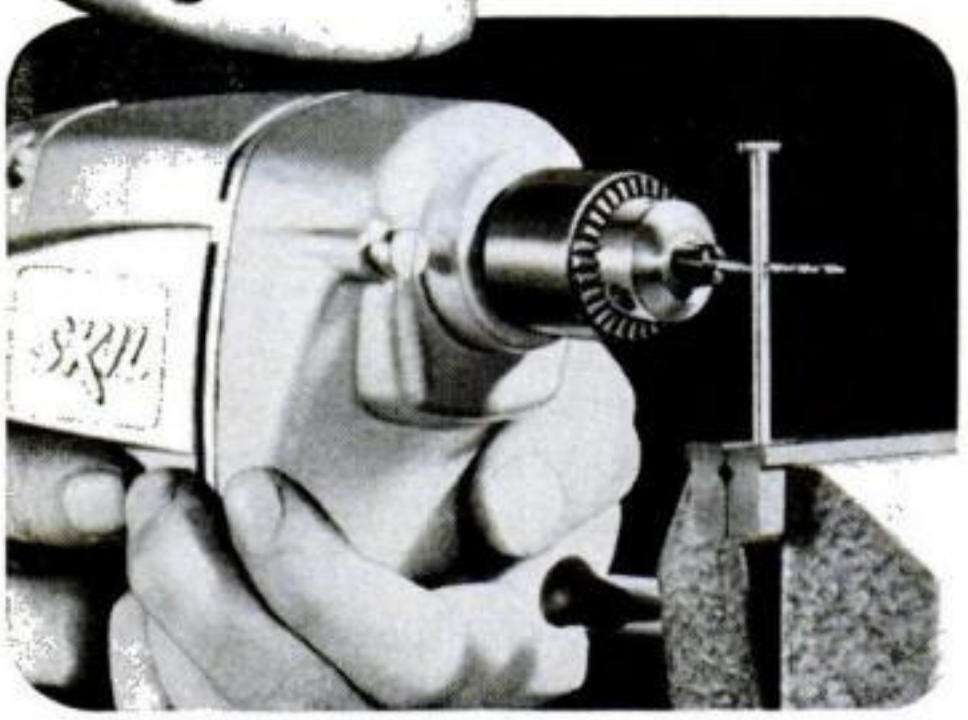

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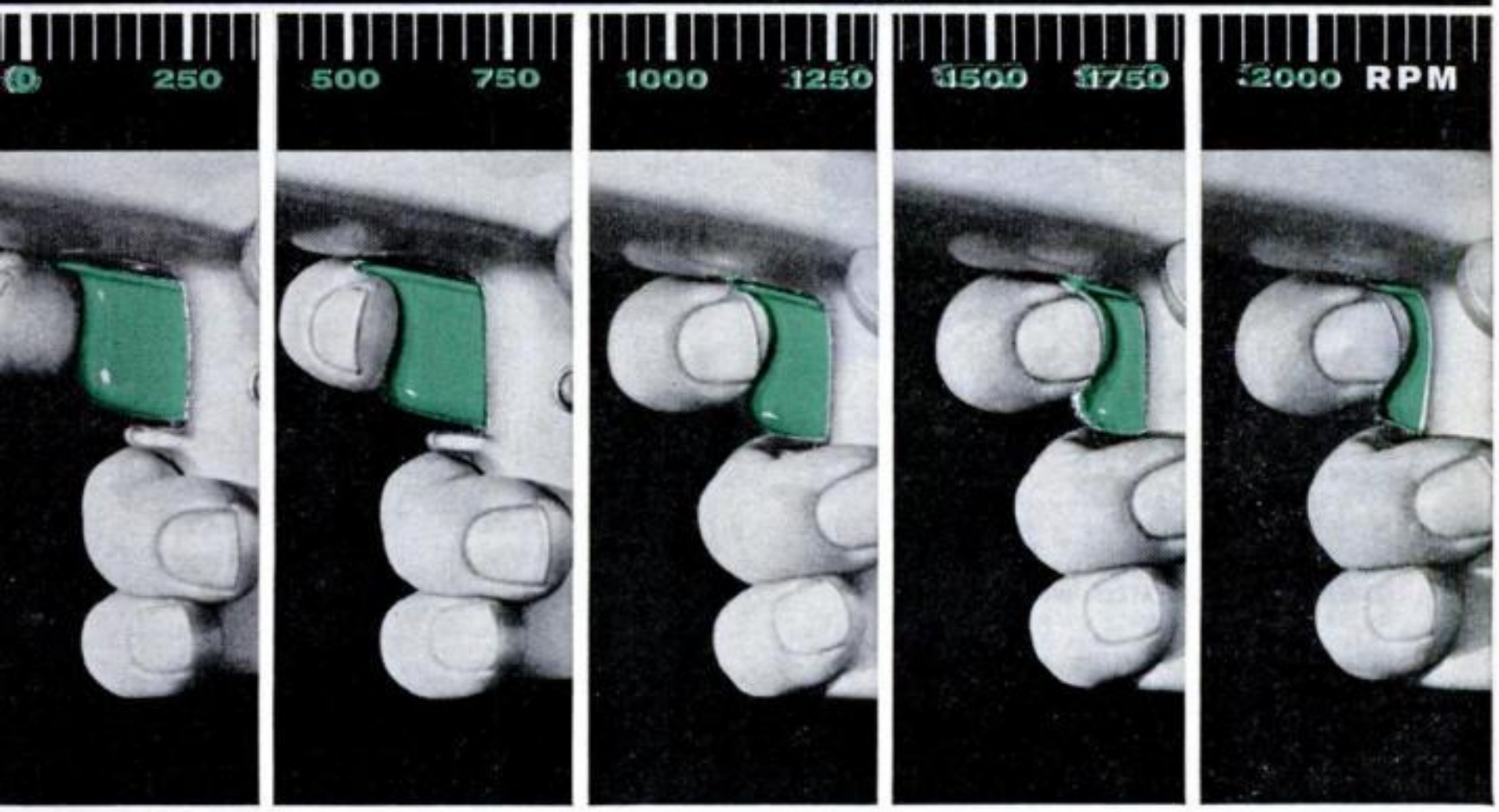

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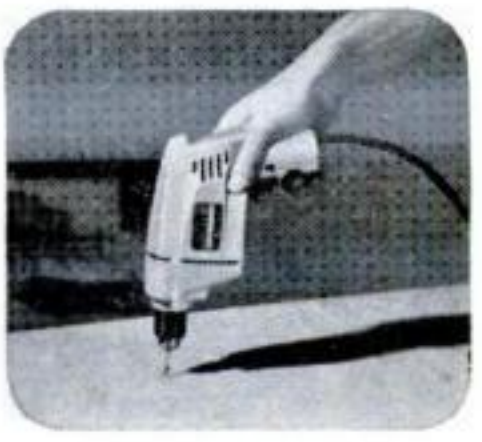

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● Levelers and keystone eliminators. Sometimes it is necessary to angle the projector upward, and the result is a picture that is wider at the top than at the bottom —the "keystone effect." The keystone eliminator lets you tilt the screen forward slightly, to eliminate this distortion. Another feature is a device that makes it easy to level the screen at the top, even though the standard may not be resting level.

● Movable roll. Some standards have the screen case mounted so that you can raise and lower it. This amounts to raising or lowering the entire screen, an advantage when you must project over the audience's head or over other obstructions.

For the most flexibility in projection, don't think only in terms of tripod standards. There are spring-loaded poles that clamp between floor and ceiling. There are various kinds of floor standards, as well as table standards. Look into them; they may work out better for you.

The newest thing in screens is the electric wall-mounted model. A motor rolls it down or up. You just push buttons.

Motor-driven or hand-operated, a projection screen on the wall makes a lot of sense. Why not paint it the color of the wall, mount it near the ceiling, and just leave it there? You pull it down to show pictures and that's all there is to it. ■ ■

Cycle car built for rails

With reduced railroad-passenger service threatened in England, this Quadcycle may find other uses than that for which it was intended—line maintenance. The vehicle weighs 150 pounds and cost $140 to build. Powered by bicycle pedals, it is being operated by its designer, Richard Poshley.

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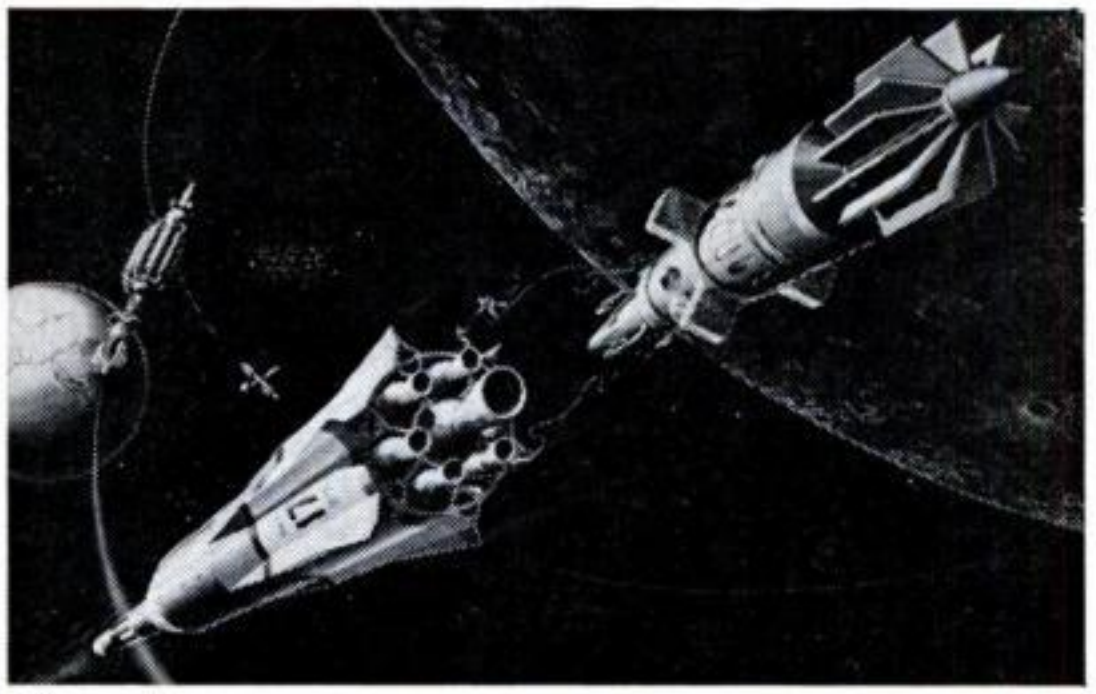

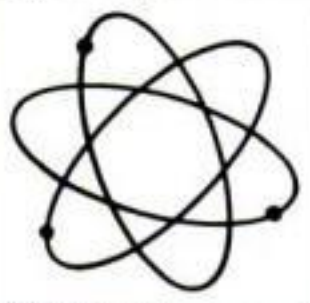

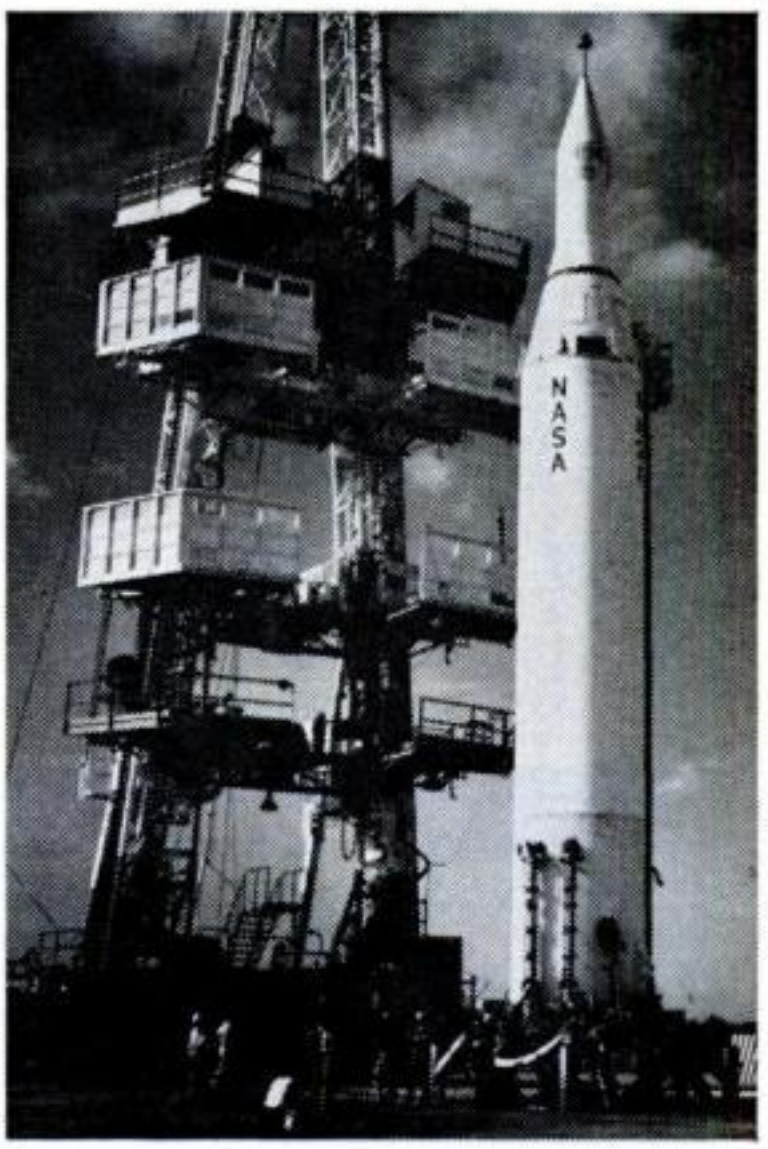

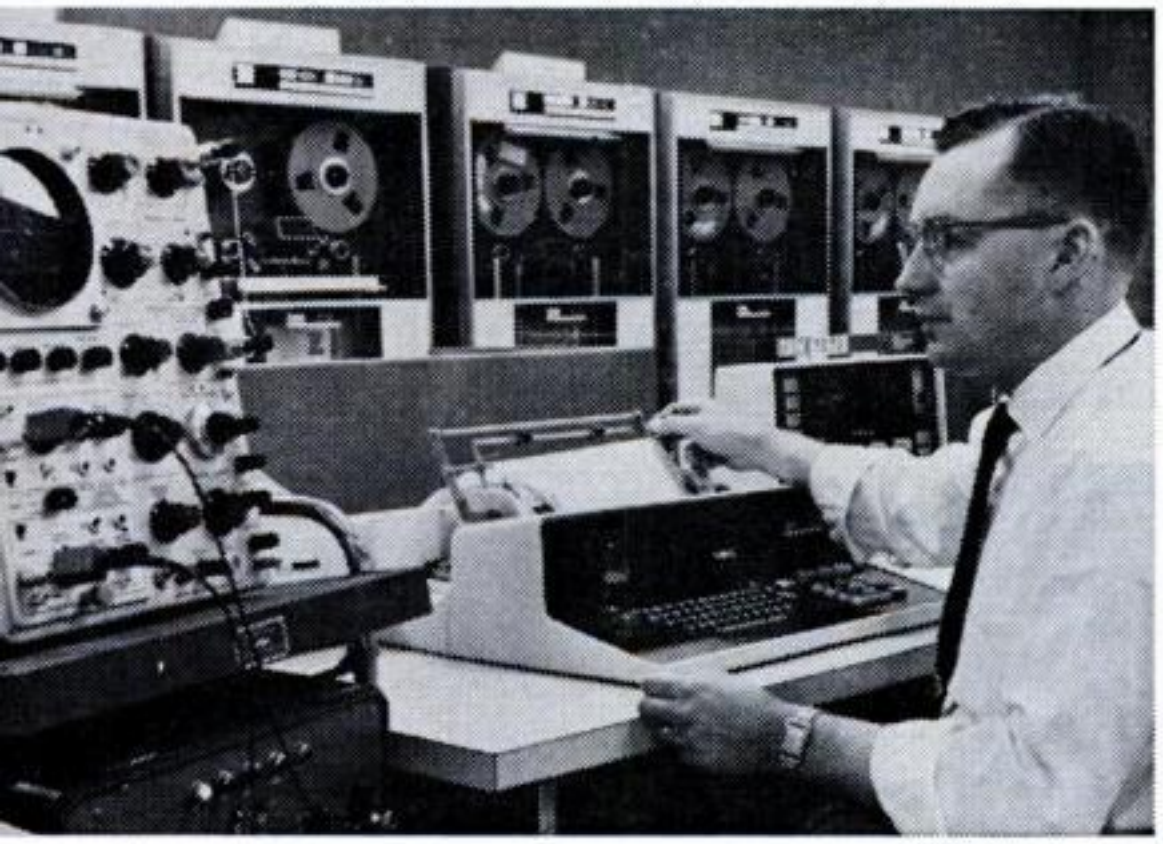

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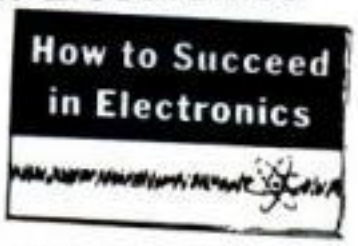

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"I'll Fly Anything!"

[Continued from page 64]

Some kind of stunt? Far from it. In a total of 200 nearly flawless flights in the Paresev, Thompson and his fellow pilots at NASA's Flight Research Center, Edwards Air Force Base, Calif., thought they had proved beyond question that a paraglider was a practical and desirable means of bringing the Gemini spacecraft down to practically a pinpoint ground landing. Once a boiler-plate Gemini capsule had been substituted for the Paresev tricycle, however, the system didn't work well. So the first manned Gemini spacecraft will be lowered by parachutes to an ocean landing, just as the Mercury capsules were. But development of the paraglider system will continue.

Riding a pendulum. The technique of flying the Paresev is a matter of shifting the vehicle's center of gravity. The pilot moves the crude pendulum he's sitting in by pushing a simple control stick in the direction he wants to go. The dartlike wing responds by taking up a new flight-path attitude. Then the pilot brings the stick back to center position, and the vehicle hangs nearly straight down from the sharply angled wing. The Paresev drops one foot for every three it moves forward, its typical flight path a steep downward slant.

The Paresev at least had a reassuringly visible wing. Not so, the M-2.

Rub-a-dub-dub. The 1,200-pound M-2, nicknamed the Flying Bathtub, has no wings at all. What lifting capacity it has comes entirely from its half-cone fuselage. Thompson has flown the M-2 during 45 of its 65 flights.

Like the Paresev, this later, highly unorthodox craft has to be towed to launch altitude, usually about 13,000 feet. It then plunges down a flight path fully as steep as the Paresev's, and at a higher velocity, for it weighs twice as much.

Why risk one's neck flying an oddball machine like this? Because, like the Paresev, it's a possible forerunner of an aircraft intended to perform an important role in the nation's expanding space program.

A returning spacecraft would not put out a paraglider wing until it had greatly decelerated during its descent through the atmosphere and had fallen to an altitude of about 40,000 feet. An operational version of the M-2, in contrast, would be flown all the way home from orbit, and be able to land anywhere in the U.S.

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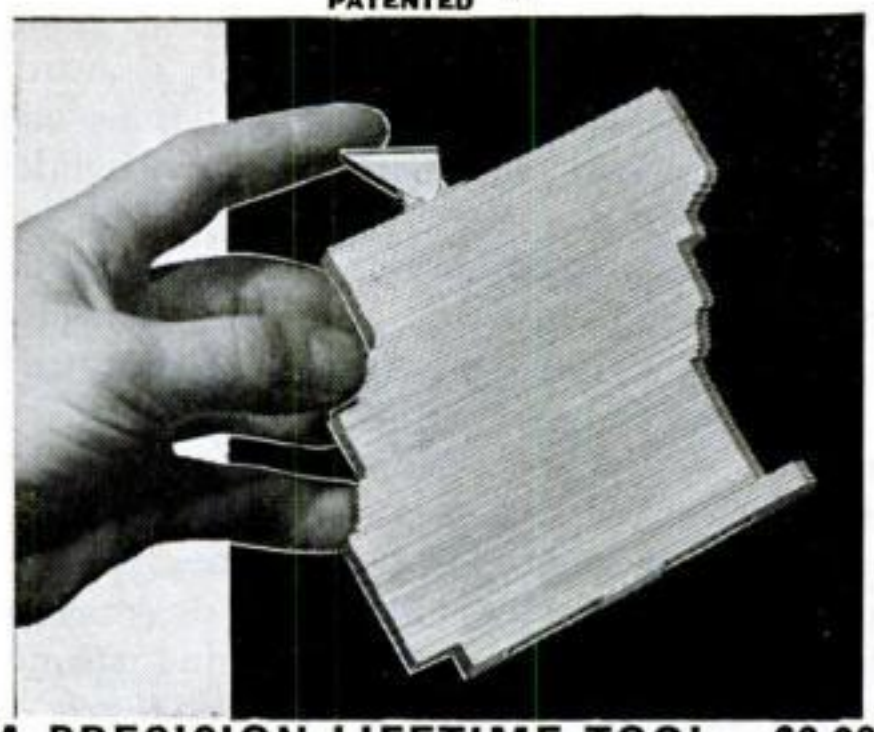

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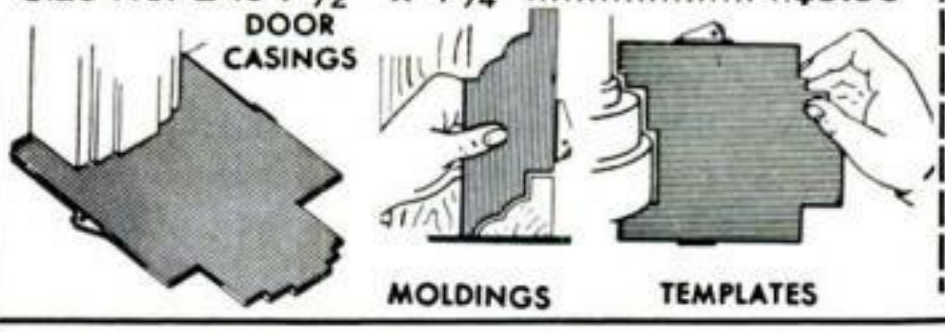

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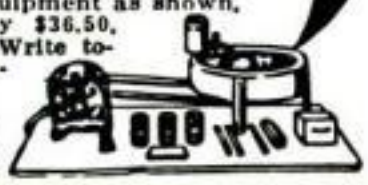

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The most remarkable craft he has ever piloted, Thompson says, is the X-15 rocket plane. He has flown this astounding plane only for the past year, mostly on low-altitude, high-heating missions. "You have to accustom yourself to tremendous pops and bangs," Thompson says of these flights. "That's the sound of various panels on the aircraft actually buckling because of differential heating across them."

What impresses him most about the X-15, which he has flown at 3,500 m.p.h. and up to 93,000 feet, is the fantastic rate at which its velocity builds.

"When you're reaching the end of the 80-to-90-second burn period," he told me, "you're accelerating 80 m.p.h. faster every second."

Reaching for the ceiling. In his seven flights in the X-15, Thompson has had only one truly anxious experience. That day he was scheduled to reduce power to minimum thrust at relatively low velocity—2,000 m.p.h.—and at 60,000 feet. When he did so, a small explosion in the engine shut it off entirely. It couldn't be relighted.

"I immediately had to trade velocity for additional altitude," Thompson explained, "to give myself more glide capability. I pulled up and started jettisoning the remaining fuel. I got up to about 75,000 feet before beginning a maximum-range glide toward Cuddeback Dry Lake, an emergency landing area where the flight controller had already told me to go. I got there with a little more altitude than predicted—somewhere around 30,000 instead of 25,000 feet. All this is gravy to the guy that's making the landing. From that point, it was like any routine landing at Edwards."

A curious aspect of Thompson's career is that he started out as an engineer, and was not a man who knew from boyhood that he wanted to be a flier. He was in flight training with the Navy during the last year of World War II, but didn't get his wings until after V-J Day.

Later, he took a job with Boeing, in Seattle, as a flight-test engineer on B-52s, making observations as best he could while other men put the big jet bombers through extreme flight maneuvers.

"During this program," he recalls, "I thought, 'If I'm going to be flying anyway, I might as well try to get a job up front'." He did. ■ ■

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Those Amazing Speed Controls

[Continued from page 139]

more. Price goes up steadily with each amp, so buy as much as you need, but not more.

The most common controls handle five to seven or 7½ amps. Since a motor may draw more than its rated amperage under load, a seven-amp control is, for practical purposes, limited to tools rated at no more than five amps, and a five-amp control is limited to tools that are rated at three- or four-amps draw.

This is usually no problem, since most portable tools are rated well below five amps. However, some heavy-duty tools may exceed five amps. For photographic use, remember that floodlights consume up to 500 watts apiece. For a two- or three-light setup, you'll want a control that can handle 10 to 15 amps.

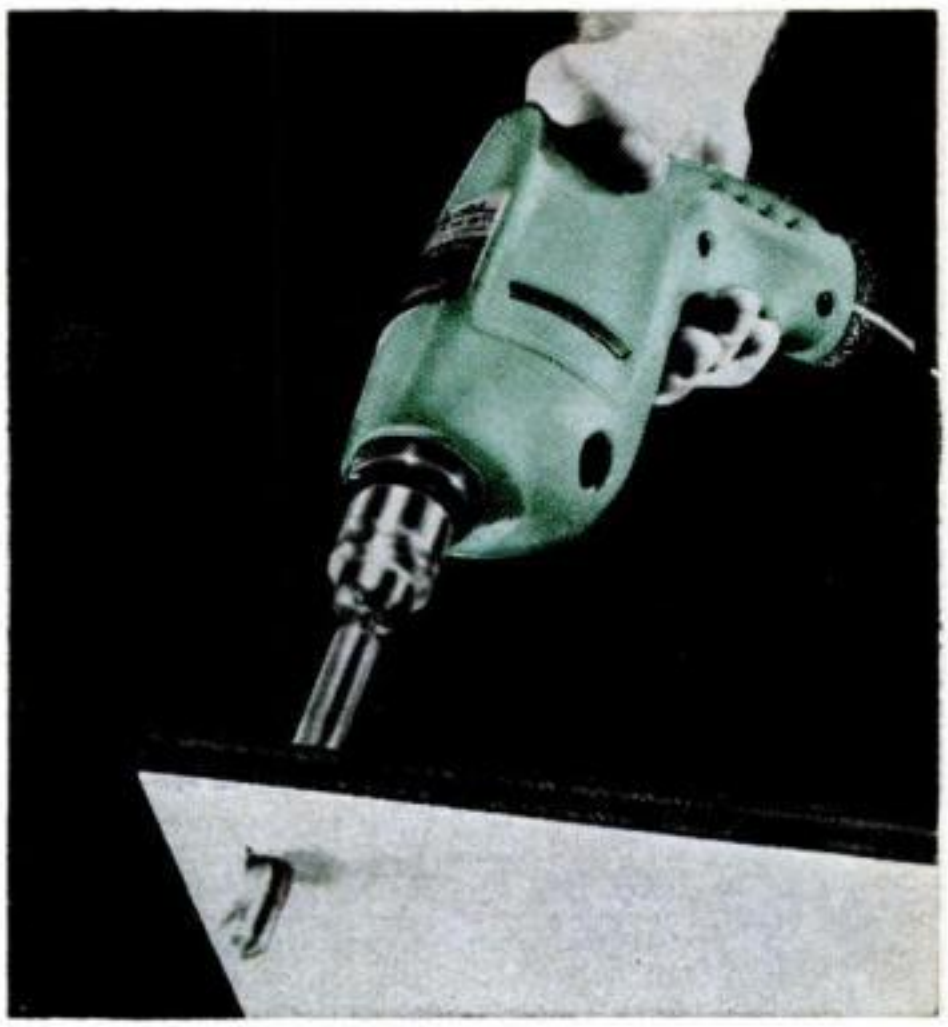
Prices for the average five- to seven-amp control run from $15 to $18. For general shop needs, it's best not to consider anything under five amps in capacity.

Other points of difference are less critical and you can take your choice. Some controls have overload protection in the form of replaceable fuses of the slow-blow type that permit momentary overloads. Others use a manually reset circuit breaker. Still others have an automatic self-resetting circuit breaker with a built-in time delay. Just be sure you get some kind of protection.

Some models have a simple on-off switch, while others use a three-way switch that gives you a choice of full power or variable power, as well as off. On the variable-power setting, you can adjust speed from zero to about 80 percent of maximum. This feature lets you switch rapidly from full speed to a preset lower speed without changing the dial setting. It also eliminates the chance of accidentally running on partial power for jobs where you want full power.

The design of some models lets you mount them in a standard wall outlet box. This is handy if you want to install a control permanently, say over a workbench.

Some of the companies that make speed controls are: Bridgeport Hardware Mfg. Corp., Bridgeport 5, Conn.; Electrotone Laboratories, 128 S. Paulina St., Chicago 12; General Electric, Wiring Device Dept., Providence, R. I.; Lutron Electronics Co., Emmaus, Pa.; Omni Enterprises, 545 N. Michigan Ave., Chicago. ■ ■



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The *Fourth* Rule for Soft Soldering

[*Continued from page 133*]

equally poor joint will result. Tests show that the best bonds are made at a soldering temperature about 100 degrees F. above the flow point of the solder used.

But since you rarely have a way of knowing or regulating exact soldering heat, a lot depends on experience and good judgment. With a torch, for instance, you're more likely to overheat than underheat. With an iron or gun, which put out less heat, the tendency is to underheat. If the solder doesn't flow smoothly and readily, it's likely to be too cool. On the other hand, if a bluish oxide appears, it's an indication of excessive heat and burning.

The problem of too little heat with an iron or gun is usually the result of using a tool that's underpowered for the job. Small 100-watt tools are adequate for light work, but for general shop soldering and sheet-metal work, you'll want 200 to 300 watts of power.

Why tinning? Tinning the work—melting on a thin layer of solder before a joint is assembled—is an important first step, especially on big-area soldering jobs. The tinning does two things. It insures that the joint is well coated with solder in places that might be inaccessible later. And it provides a "tooth" that additional solder can cling to more easily.

You can also take advantage of the fact that molten solder will flow into a narrow crack by itself because of capillary action. Joints that are deliberately designed with hairline gaps of .003" to .006" between the parts help to draw the solder in and are stronger than joints so tightly pressed together that there's no room for solder to flow into them.

The right flux. While there are many special fluxes, two main kinds handle nearly all ordinary shop work.

Rosin paste, containing a mild acid, is the time-honored flux for soldering nonferrous metals. It melts at 260 degrees and chars at 600. Largely protective in function, it excludes air from the metal to keep it from tarnishing as it's heated. If a metal tarnishes before the solder can reach it, the solder won't bond well.

Acid flux, a chemically more powerful agent, is needed for soldering iron and steel. It has the strength to dissolve the heavy oxidation that takes place on ferrous metals. Although available in paste form,

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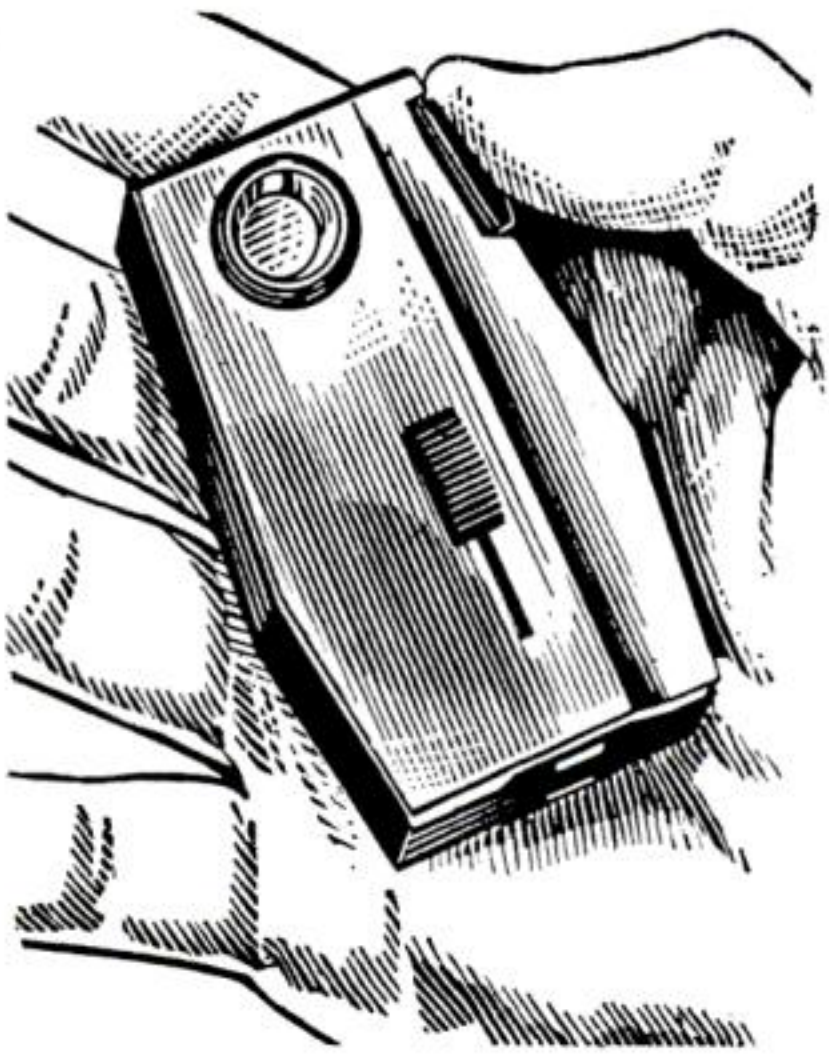

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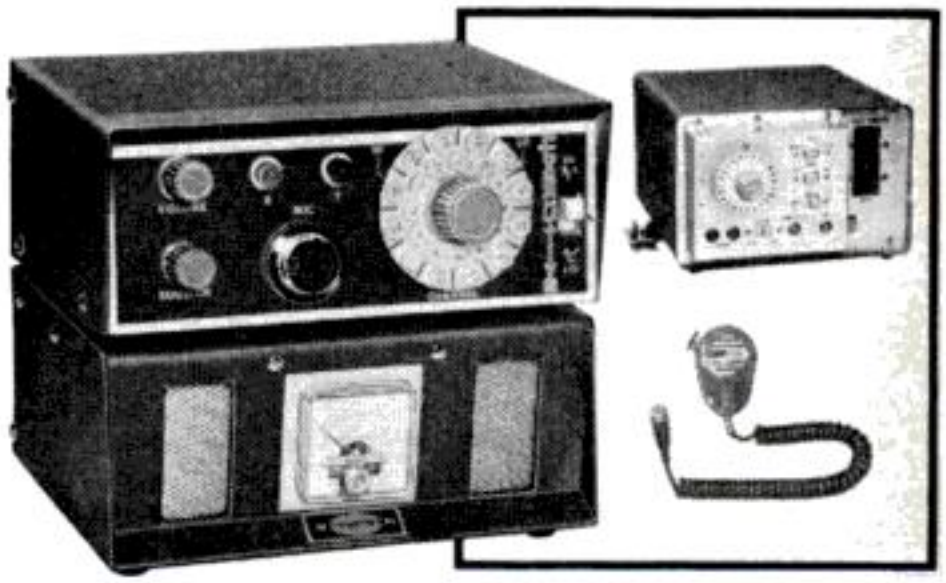

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The *Fourth* Rule for Soft Soldering

it's more commonly a liquid. When it's heated, the water in the solution evaporates and a layer of acid salt is deposited. Continued heating melts the salt, and the molten acid cleans the metal chemically. Molten solder then flows under the molten salt and displaces it.

For effective fluxing action, the acid salt should melt at a temperature below the melting point of the solder used. But zinc chloride, the main ingredient in most acid fluxes, melts at 500 degrees—well above the melting points of most solders. For this reason, the zinc chloride is modified with ammonium chloride (sal ammoniac). This lowers the salt's melting point to 350 degrees.

Both rosin and acid flux leave a residue. The worst of the two is acid residue. This consists of fused salts which, unless completely removed, will absorb moisture from the air and eventually corrode the joint apart. Avoid using acid flux, therefore, on work that can't be washed thoroughly in hot water and washing soda to remove the residue. And never, in any case, use acid flux on electronic circuits or stranded cable, which can't be cleaned adequately.

Even rosin flux can be troublesome if it contains chemical activators, as many do. These activators make the flux slightly electrically conductive. If the flux is applied carelessly on wiring, its residue can cause shorting and arcing.

The safest known flux for critical electrical work is a syrup or paste of water-white rosin in organic solvent. This is the flux that's put into rosin-core solder made especially for radio and TV use. Since this is manufactured in accordance with government specifications, you're better off using a rosin-core solder on electronic work than a separate rosin paste that might contain harmful ingredients.

Wire solders in both the rosin- and acid-core types are handy for small, intricate soldering jobs. For large-area work, you need either solid-core wire solder or heavier bar solder, both used with a separate flux. Though not as convenient, the use of a separate flux swabbed on first has the advantage of getting the agent thoroughly on a joint *before* the solder is applied. ■ ■

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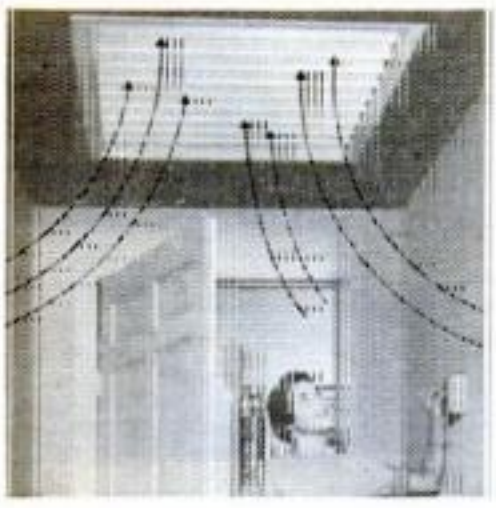

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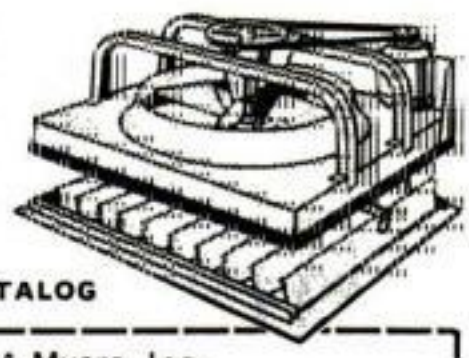

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Can You Answer These Questions About Blood?

[Continued from page 125]

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Can blood from the dead be used?

The Russians have long said yes. Annually, in a single institute in Moscow, more than 3,000 pints of blood have been obtained from people who died from heart attacks, suicide or accidents. And physicians at several U. S. institutions have reported excellent results with blood drawn from a jugular vein in the neck within six hours after death and stored.

Transfusion of your own blood?

One promising new procedure uses your own blood. In advance of an operation, you simply donate one or two pints. You don't miss it; your body quickly produces more. The blood is refrigerated, kept ready for you if you need it.

Can you have too much blood?

In a disease called polycythemia vera, there is an abnormally large number of red blood cells, leading to headache, vertigo, weakness, abdominal pains. Simple bloodletting often provides relief.

Doctors at Tulane University have discovered that people with the most common type of heart trouble—coronary-artery disease, which causes most heart attacks—often have a greater concentration of red blood cells than do healthy people, thus making their blood thicker. Frequent small bleedings reduce the thickness and permit freer blood flow, improving circulation to the heart muscle.

There's even some hope now that one of medicine's oldest dreams—for a universal diagnostic test, one that can spot and identify every conceivable disease in its earliest and most easily cured stages—may eventually be realized. Early results of work by investigators at Johns Hopkins suggest that illnesses as different as cancer, tuberculosis, and schizophrenia may be identifiable through characteristic changes they produce in hitherto obscure constituents of blood—the serum mucoids, which are combinations of proteins and carbohydrates.

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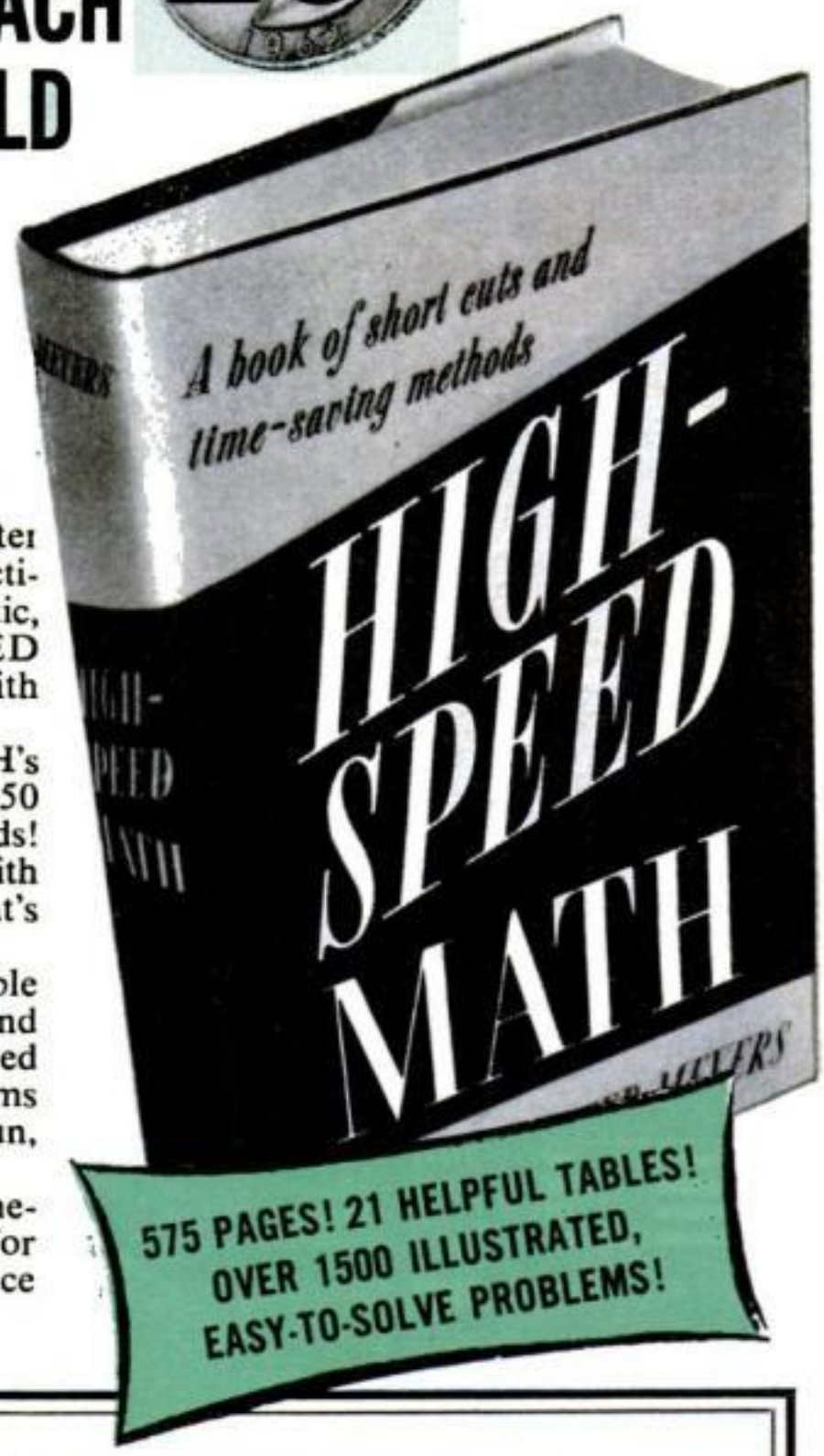
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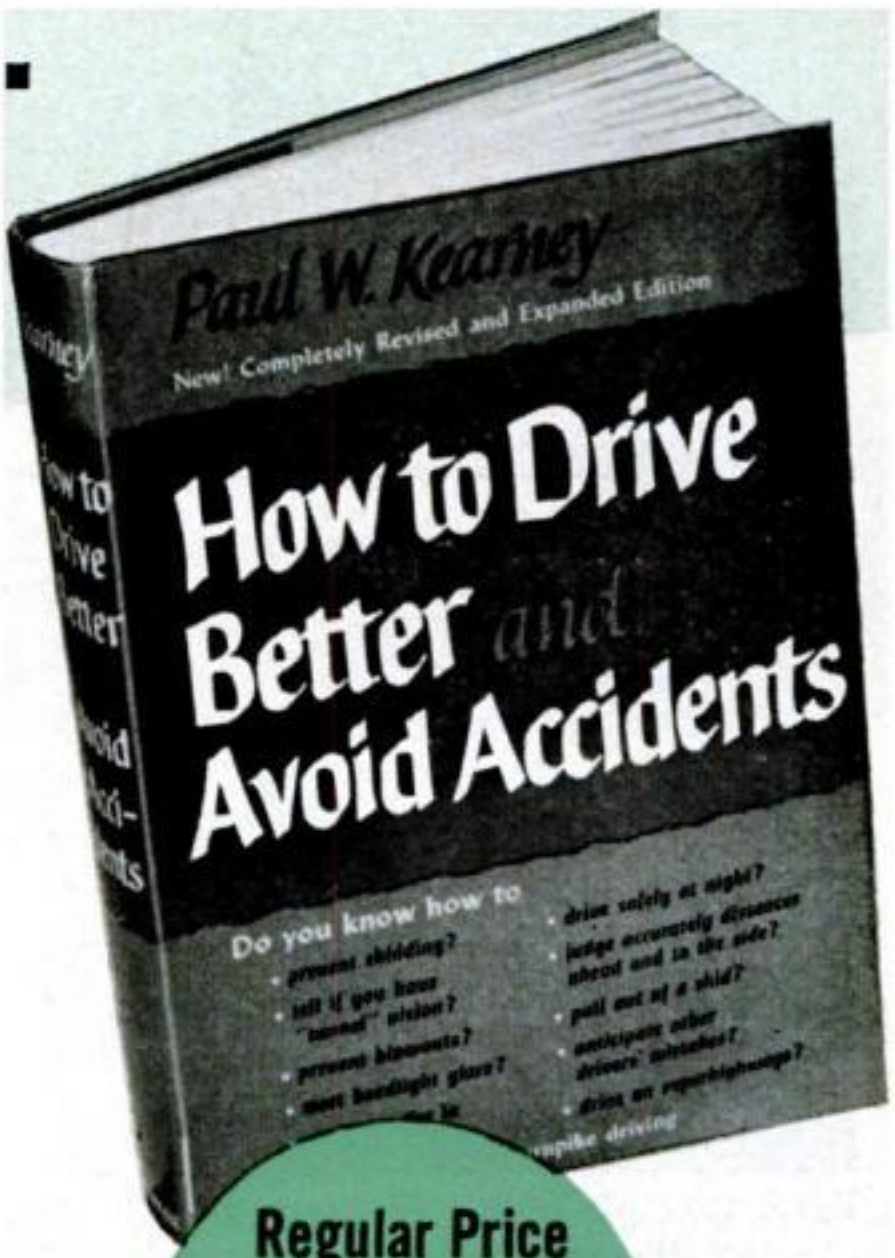

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This is the SOVEREIGN. A 19-ft. news-making tiger of a boat. It's ARMOR-HULL, new "sandwich" hull construction technique. To make it, Lone Star used aluminum for the outer hull, FOAM-PAC for the center, fiberglass for the inner hull. Then, bonded them together as one material with unrivaled qualities of strength, flotation and impenetrability. There are several reasons why Lone Star is the first company to conceive and create ARMOR-HULL. One, FOAM-PAC. Lone Star developed this high-density polyurethane foam, with 7 times the strength of ordinary foam, three years ago at a cost exceeding $100,000. Two, production skill. Lone Star's two decades of boat building experience make it possible to originate a new hull . . . load it with equipment . . . price it competitively. Result — the SOVEREIGN. Impervious to leaks. Next to impossible to sink. Practically rivet-free so it goes much faster . . . in well-insulated quiet. Check smart-looking outboard and I/O versions at your Lone Star dealer's. Or write today for free color catalog on the "Funmakers", Lone Star's complete line of aluminum and fiberglass fishing boats, runabouts, cruisers and boat trailers.

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LONE STAR BOAT COMPANY

Headquarters Plant: 1037 Industrial Ave. • Plano, Texas

Doing Something About the Weather

[Continued from page 84]

First into their IBM Stretch computer, one of the world's most powerful, go physical laws governing the atmosphere's most important motions—in the form of 15,000 instructions. Then they feed in a 400,000-item description of the world's weather at a given instant: wind speed and direction, temperature, and humidity at 10,000 places on earth and nine levels of the air above them. Flashing into action, the computer forecasts the weather at coming five-minute intervals. To simulate a single day's weather, it performs 10 billion operations—and more than a trillion to predict weather for 100 days, a typical trial period. Its forecasts emerge as printed weather maps. Comparing them with the actual weather shows how accurately the model works.

The feat is new. Computers equal to the task are so recent, that the first promising atmospheric model was born only three years ago. Improved models now can test the effects on weather of "gross" alterations of the earth's surface—including one or two of the most grandiose weather-control ideas. Seemingly in sight before long are more-sophisticated models that will show all plans' effects—or go backward, from wanted results, to pick the plan—and so clear the way to apply them.

This weather control of the future will take international teamwork—to make sites available, to carry projects out, to see that a plan helping one nation doesn't harm another. Is that in the cards? There are hopeful omens—like a U.S.-Soviet pact to exchange weather data, signed last fall.

Of course all this won't happen tomorrow. But it doesn't look too remote, either, when one NSF-backed researcher is already studying how the southwest U.S. could be changed by weather control—"specifically, the effects of 1-, 5-, 10-, 20-, and 50-percent increases in the mean annual precipitation." And if that's far from where you live, be patient—they may get around to your part of the country next.

How will you have your weather—wetter, drier, warmer in winter, cooler in summer? Or would it appeal to you to have every weekend a fair one, and rain only on Wednesdays? (Even that's conceivable, by stimulating an apparent natural weather "cycle" of about a week.) Whatever your choice, the time may not be far away when the weather-makers can deliver it. ■ ■

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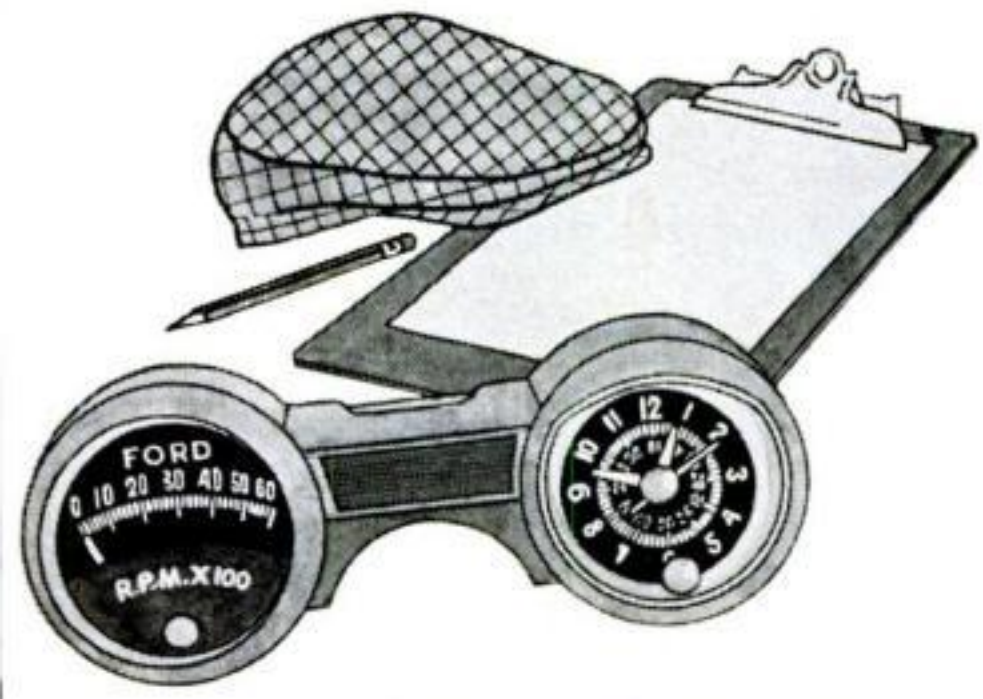
Who's got everything for your Ford

from Rally-Pacs...



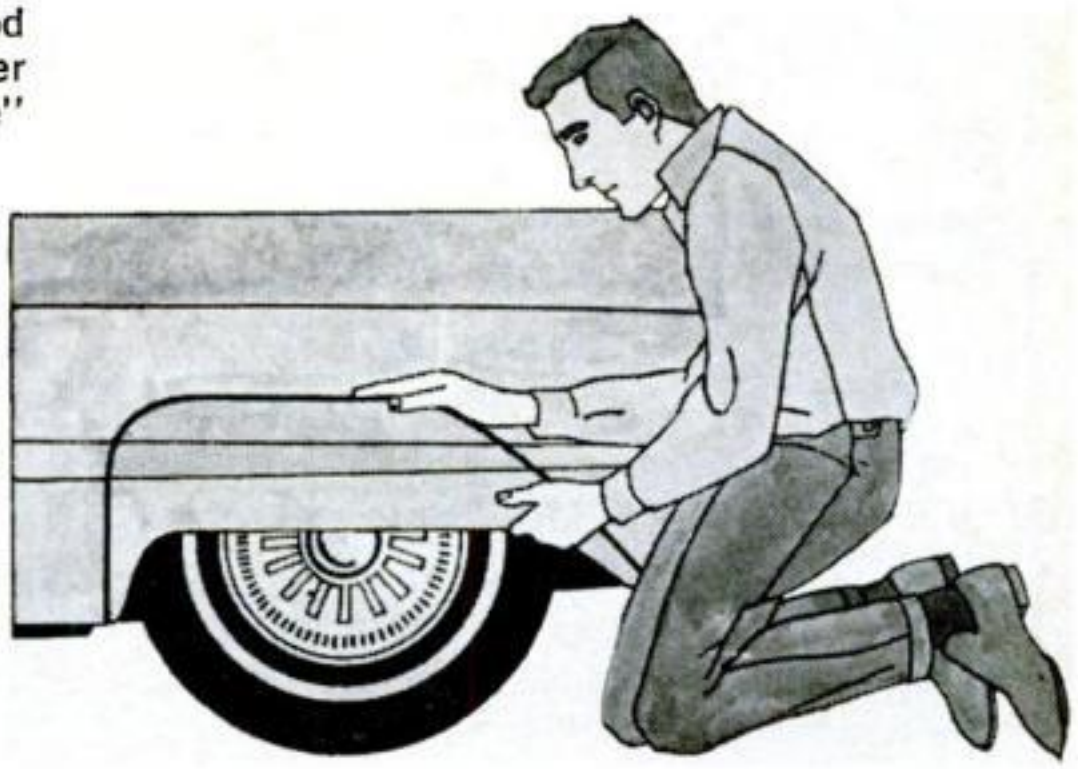
A must for performance enthusiasts, this Mustang Rally-Pac is a unique, illuminated, twin-pod cluster with a 6,000 or 8,000-rpm tachometer and a precision electric clock. Has "camera case" finish. Mounts on steering column. $79.95*

to Tri-Pacs

This kit can give your car that showroom look. Has car wash for 16 washes, an auto polish designed for all car finishes, a no-rub-chrome cleaner. $2.99*

Floor Mats...

These durable floor mats come in two styles—contoured full-front and rear or twin 2-piece front and rear mats. Available in colors harmonized to your Ford's interior—rubber or vinyl. Fronts from $7.95,* rears from $3.80*



to Fender Shields

Here's a way to add to the fine styling of your Ford. These shields are easy to install, have a lock device. Available in gleaming stainless steel or primed for painting. From $8.99*

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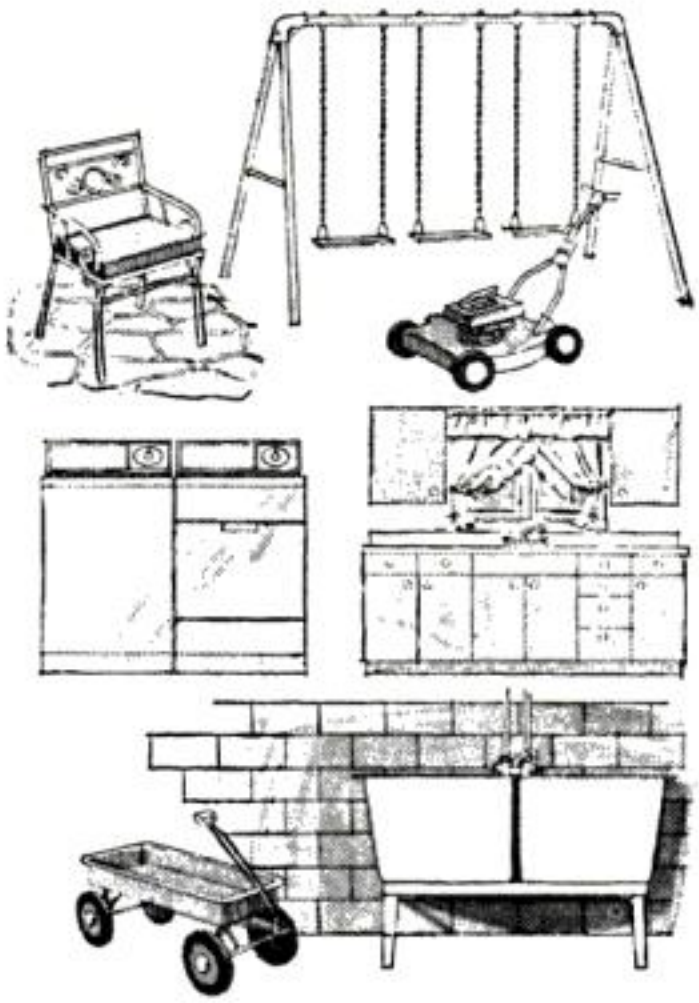

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Shopping for a Suburban Tractor

[*Continued from page 157*]

price tires, attachments of marginal use, fenders, and padded seats.

Nearly all manufacturers talk a lot about the power train, the system by which power gets from engine to drive wheels. The most common method is from engine to drive shaft by a belt. Chains also are used and a combination of chains and belts. The belt system has many advantages, especially in economy. Sometimes the belt acts as a clutch, by means of a tensioning device. Some machines have regular clutches. At least one has no clutch; you throttle down, shift, then throttle up.

How fast? Forward speed of all tractors has been upped lately. Not every manufacturer thinks this is good. Most say that three forward speeds are sufficient—one in reverse. They say that six m.p.h. is the top speed needed. One reports:

"At six m.p.h., traveling on a flat surface and making a sharp turn, our tractor starts to lift the inside rear wheel." The implication: Given a little slope, the machine—or anybody's machine—might flip at six m.p.h.-plus when making a tight turn.

More manufacturers are interested in a slower speed than a faster one. The reason: With some attachments, such as the tiller or snowblower, high engine speed must be maintained, but slow forward speed is essential. The answer is a low gear that revs up but doesn't move fast. One manufacturer offers an adjustment of forward speed separate from engine speed. Some makes offer a continuous—infinite—speed range.

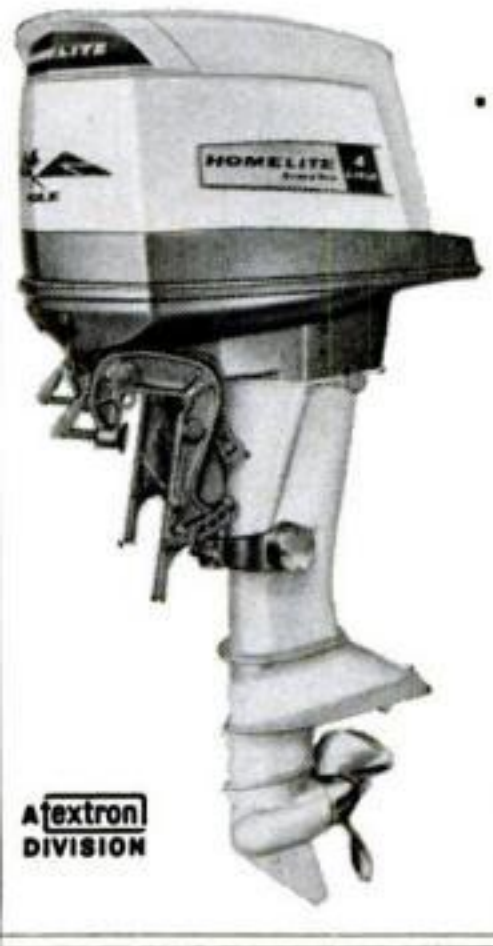
A common method of providing many different speeds is through a regular three-speed transmission system plus a two-speed shift that doubles speed to six.

The manufacturers nearly all come out for a true differential, and some of them insist on a differential that you can lock. One experienced tractor man says:

"Every time you reach the spin-out point, one wheel goes first. If you can lock the differential you increase your go-ahead power to the traction of the best wheel."

Whether this feature is important depends on the sort of tractoring you do. If your needs involve bucking snow, some bulldozing, hauling a plow, or running up much of a grade, give serious thought to the locking-differential feature. ■ ■

The LIVE ONE!



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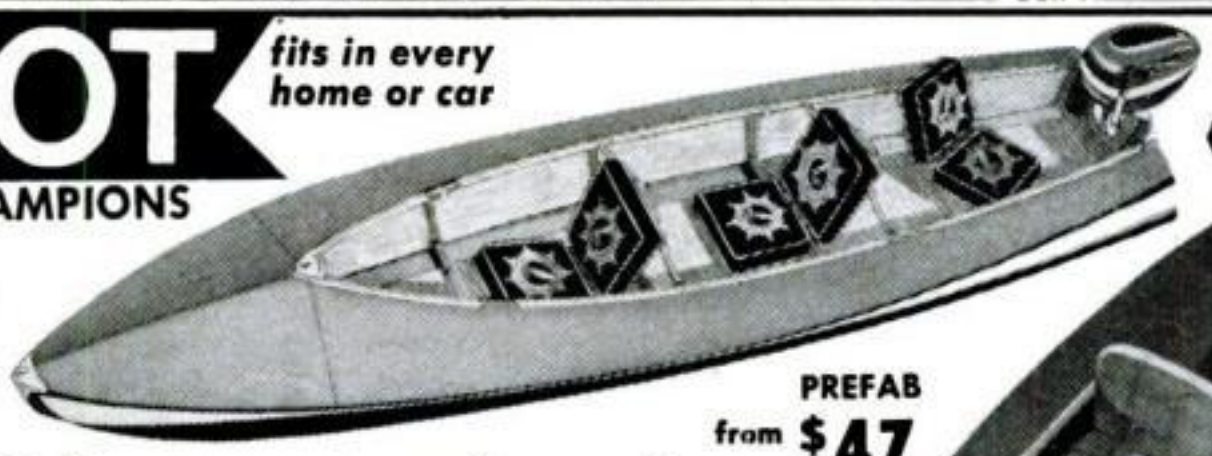

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50,000 Miles Without an Oil Change

[*Continued from page 61*]

cleaner than the control car as well.

● The engine of Test Car One appeared to have suffered no damage, despite the sludge. In fact, the Dade County Sheriff's Department was sufficiently satisfied with the results to announce that it was going to continue to use the Bergstrom centrifuge on both test cars.

● For 1964 Plymouths, the Chrysler Corp. specified that the "positive crankcase ventilation valve" (commonly known as the PCV) be cleaned or replaced each six months, or at every second oil change. At the end of the POPULAR SCIENCE test, the PCVs on both test cars were in good condition, though neither had received any attention for the 50,000 and 35,000 miles respectively registered.

● The Bergstrom company was so pleased with the results that it made a surprising announcement—it would accelerate its research on an automobile centrifugal oil cleaner with a view to manufacturing it, perhaps within a year.

But as with any new idea, the Bergstrom purifier raises some questions. It also propounds a mystery. The results confound accepted theory on oil changes.

The ultimate: no change. In a paper delivered before a Society of Automotive Engineers meeting a year ago, B. W. Malone and B. M. Henderson of the Shell Oil Co. said:

"The ultimate in long oil drain periods for passenger cars is no oil drain. . . . Crankcase oils are never drained in many locomotive diesels, large aircraft engines, and large stationary engines . . . We do not believe this would be practical for cars."

Test Car One burned a quart of oil on an average of each 1,959 miles.

So at this point the Bergstrom oil purifier is like the bumblebee—aeronautical engineers say the bumblebee hasn't enough wing area to fly, but the bumblebee doesn't know this, so fly it does.

One question raised by the test was why the oil's high acid content did not seem to harm the test-car engines.

A Bergstrom engineer, Landis Ketner, contends that an oil's acidity reading means nothing. He quotes a private laboratory as saying that no general relationship between engine-bearing corrosion and acid content is known. In point of fact, a month after the close of the PS test run, the oil of Test

CONTINUED

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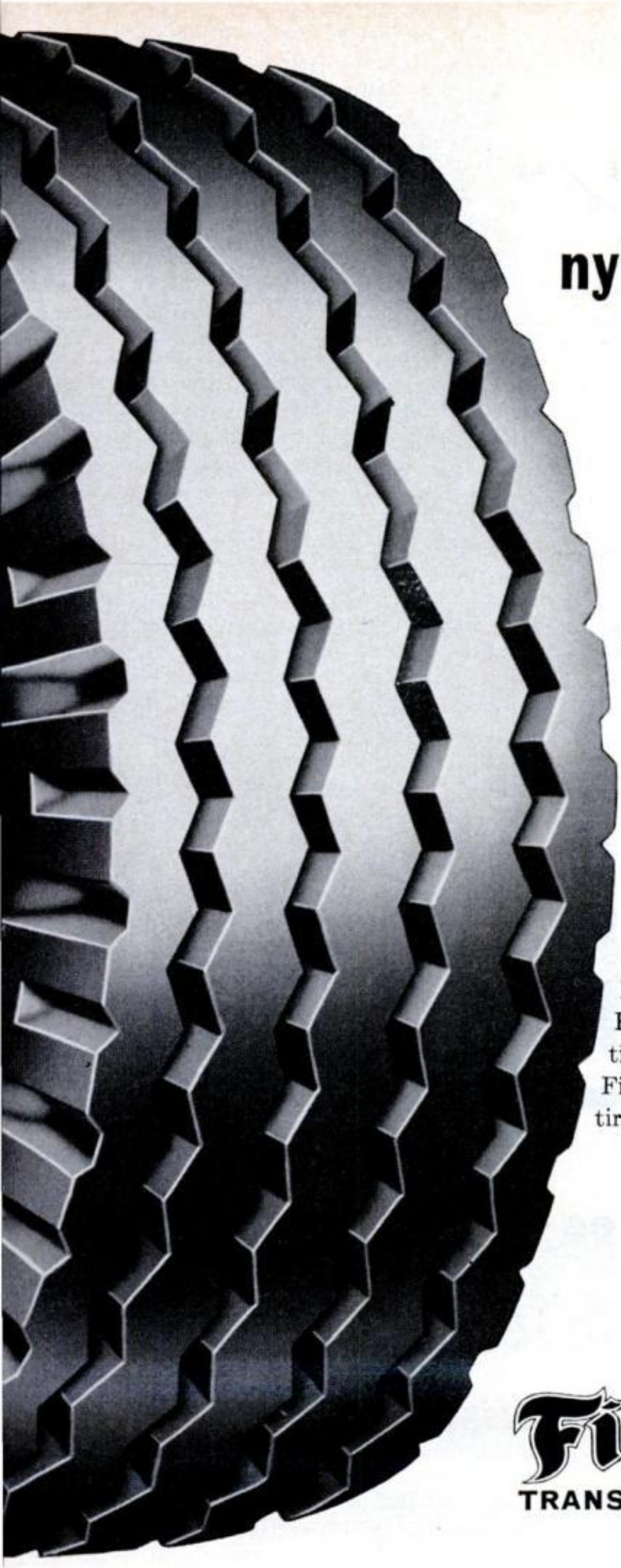

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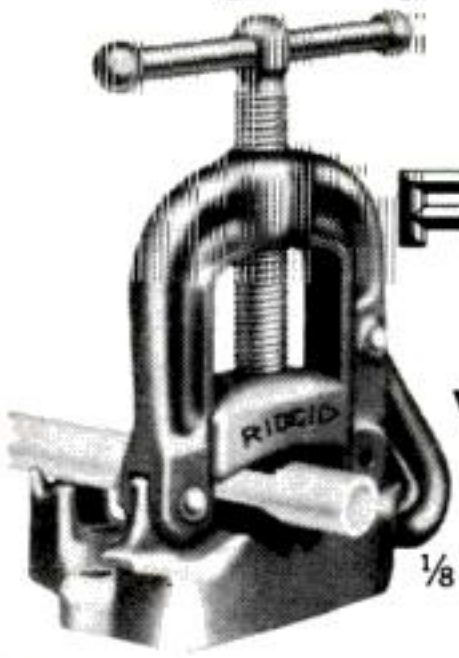

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Can Two tested out alkaline, not acid. This was not explained.

And the mystery: One laboratory hired by POPULAR SCIENCE remarked of a lubricity test on oil from Test Car One after 50,000 miles, "Analysis . . . could not be performed due to fine particles contained in the oil. Under standard conditions, the oil would fail the lubricity test."

Why wasn't the engine damaged?

As a wild guess, one oil-company chemist told POPULAR SCIENCE that the additives persisting after use were a pretty good index to the oil's value as a lubricant. "If you've got half of the additives originally put in," he said, "you're okay." (As noted previously, the POPULAR SCIENCE test showed very little loss of additives.)

Bergstrom suggested that the extraordinary sludge accumulation in Test Car One's engine could have been due to two factors: 1) The 10,000 miles wholly without oil filtration, and 2) hard car usage in the absence of sufficient capacity—between cleanings—for storing, in the purifier, the sludge removed from the oil.

Bergstrom also pointed out that the sludge was soft and putty-like. The sludge that damages engines, the company said, is hard and asphalt-like.

Those small particles. The purifier, the Bergstrom company pointed out, has one advantage that puts it far ahead of the conventional filter. It removes from engine oil much smaller particles of solids.

Bergstrom ordered one lab check on sludge particles from oil used in one of the diesels in Canada. The report said that 79.75 percent of the solid particles, measuring up to 1/1,600 inch in diameter, would have passed through and been recirculated in the engine if the car had been equipped with a standard oil filter.

Still, Bergstrom is experimenting to see whether a faster-turning rotor will remove the fine particles.

The design of the Bergstrom automobile purifier to be offered for public sale will be modified considerably. For one thing, it will have almost three times the sludge-storage capacity of the ones used in the POPULAR SCIENCE test. In the beginning, Bergstrom believes, an oil-change interval of 30,000 to 35,000 miles will be recommended. But the interval will vary, depending on the use to which the engine is put, including driving conditions. ■ ■

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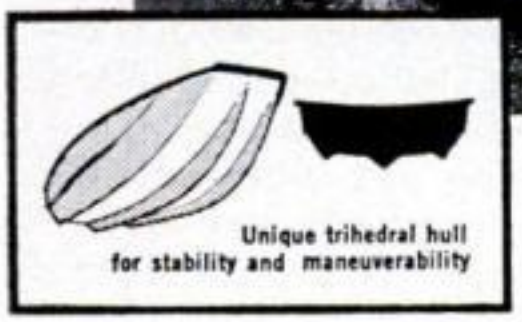

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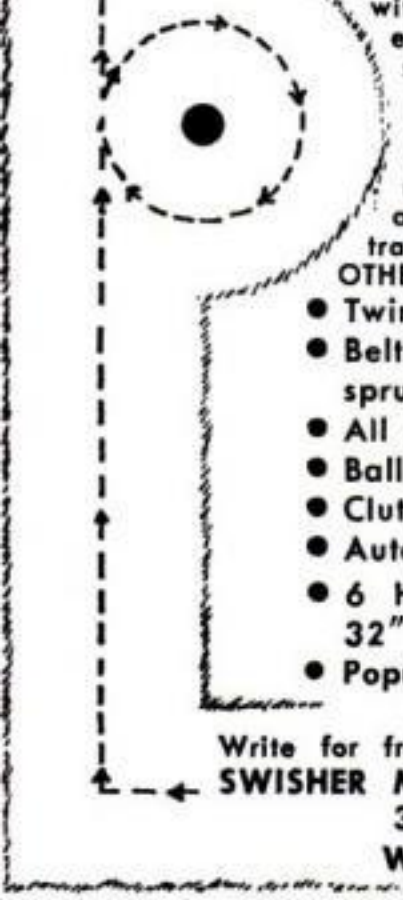

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Test-Driving the Intermediates

[*Continued from page 76*]

Fairlane was competitive with it in performance. Seating positions and interior room are good. It is a satisfactory family car, not outstanding in any one respect (in this group), but willing and able.

The Coronet. Dodge's entry turned out to have the best combination of ride and handling in the group—though the Fairlane's ride came awfully close to it. The Coronet was the most nimble and responsive of the four cars, with the Chevelle a near second. It had more feedback from the front wheels—more road sense—despite a smooth, near-effortless power steering.

Dodge's forward vision is as good as that on the other three intermediates, thanks to a shortening of the hood for '65. The Coronet has especially good headroom (two inches over the others).

Engine options and drive-line specifications are virtually identical on the Coronet and Plymouth Belvedere. The 273-inch V-8, introduced last year on the compact Valiant and Dodge Dart, is new for both the Coronet and Belvedere.

The Classic. This intermediate seemed to have the tightest body. The windows, for instance, were so snugly fitted that they were stiff to raise or lower. The seats were comfortable. The car has lots of power for any normal driving, and the transmission's delivery of power is smooth through all speed ranges.

The car we tested had a control called Shift Command, superimposed on the automatic box to permit you to shift manually among the three speeds regardless of throttle setting. (Most automatic boxes set limits on their shift points. As an example, some won't down-shift from high to second above 55 m.p.h. regardless of how hard you press the accelerator past "detent.") Or, according to your pleasure, you can put the Rambler lever into Drive and let the automatic control up-shift you one-two-three.

The Rambler ride is good, but not as good as the Coronet's and a shade less comfortable than the Fairlane's. The one weak point, compared with the other cars, is a lack of road sense and precise steering feel. There is a tendency to overcontrol as a result.

My choice among the four cars? It's a coin flip between the Coronet and the Fairlane, with the Dodge favored for long trips, the Fairlane for short ones. ■■

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Hundreds of people like yourself are making cash like this—$20 to $30 a week—right now in spare time. "My spare time saw filing business has made me $952 these first ten months"—says R. T. Chapman. Many have built a complete sharpening service with year-around profits. You can, too, simply by following, the sure, easy Foley plan.

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You can sharpen combination (rip and crosscut) circular saws, hand saws, band saws, crosscut circular saws—and do a perfect job every time without experience or special training. The precision Foley Filer does it for you automatically! A complete repair shop in one machine! Set up in basement or garage, work your own hours in your own way and earn big sparetime profits.

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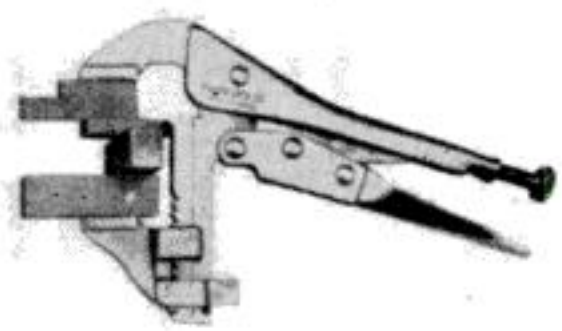

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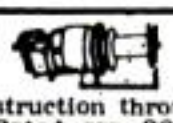

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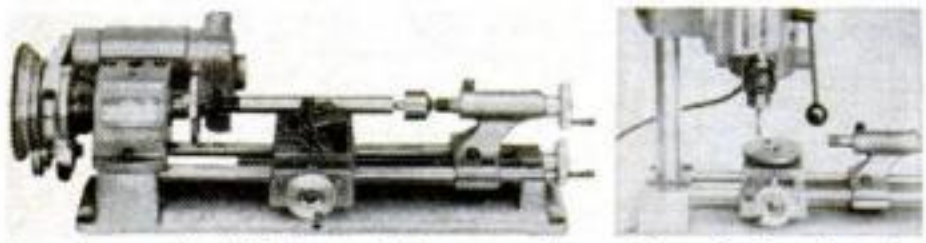

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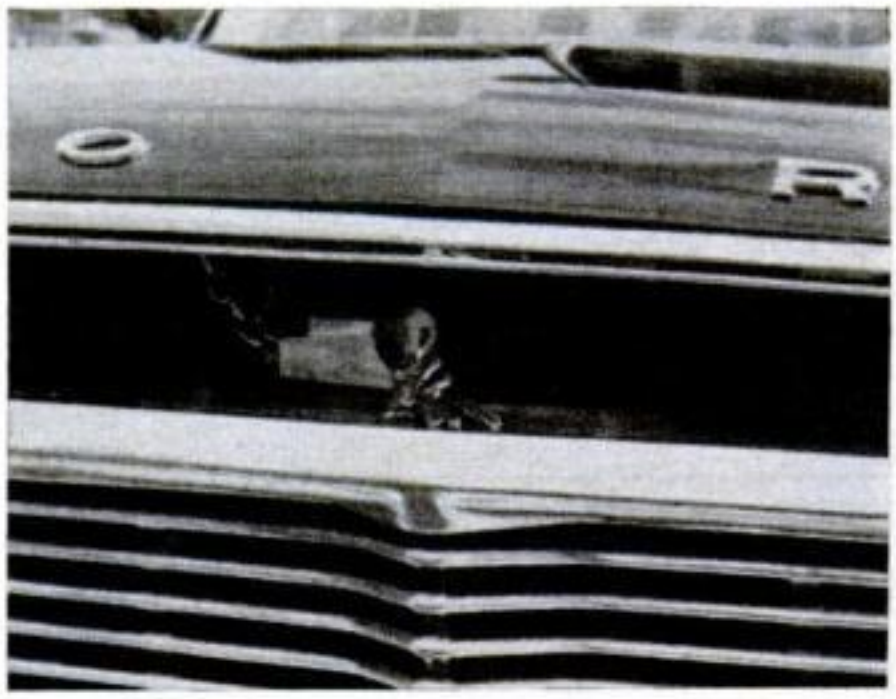
Short Cuts and Tips FROM PS READERS



Lock for front-latching car hood

My front-latching car hood can now be opened fully only with a key, thus foiling ignition jumping and battery theft. I adapted a standard lock-type chain bolt to the job. The hood can be unlatched and opened just enough (above) so you can get the key into the lock and loosen the bolt. The bolt and its chain then swing up (below) along with the hood. You lock the hood by reversing the procedure. The lock and chain were each bolted securely in place.—*Stephen Fischer, NYC.*

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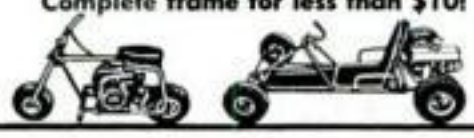

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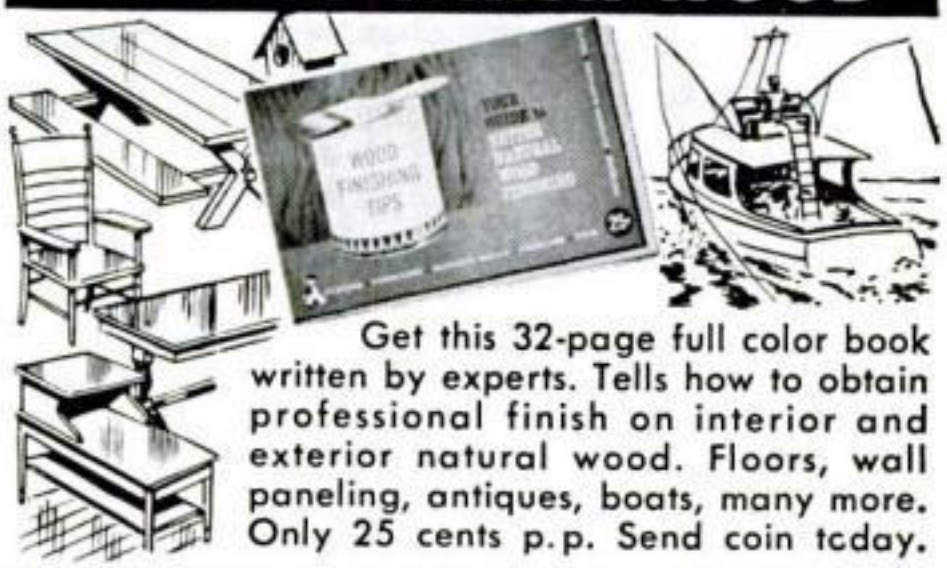

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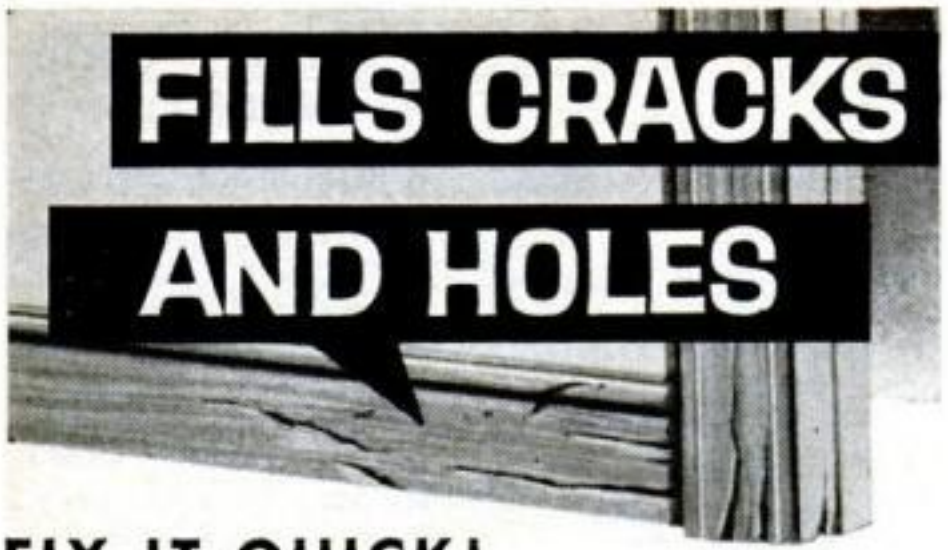

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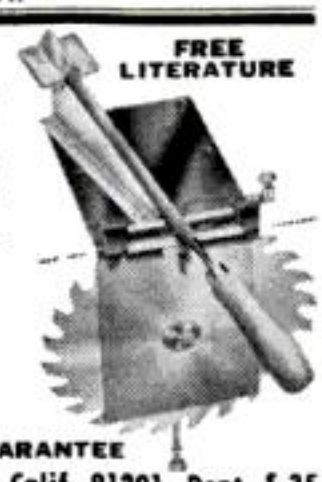

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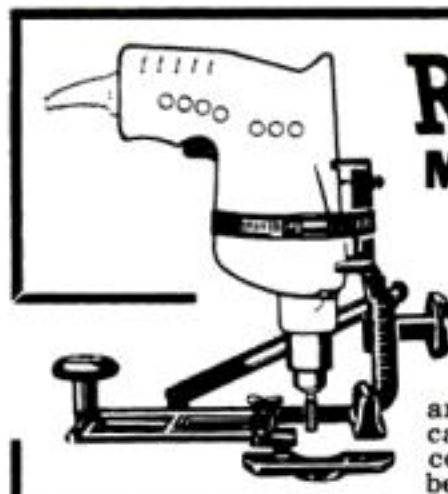

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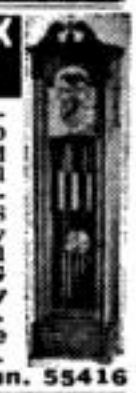

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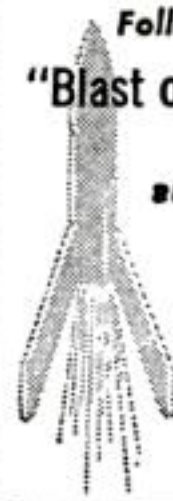

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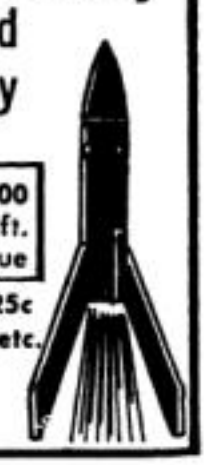

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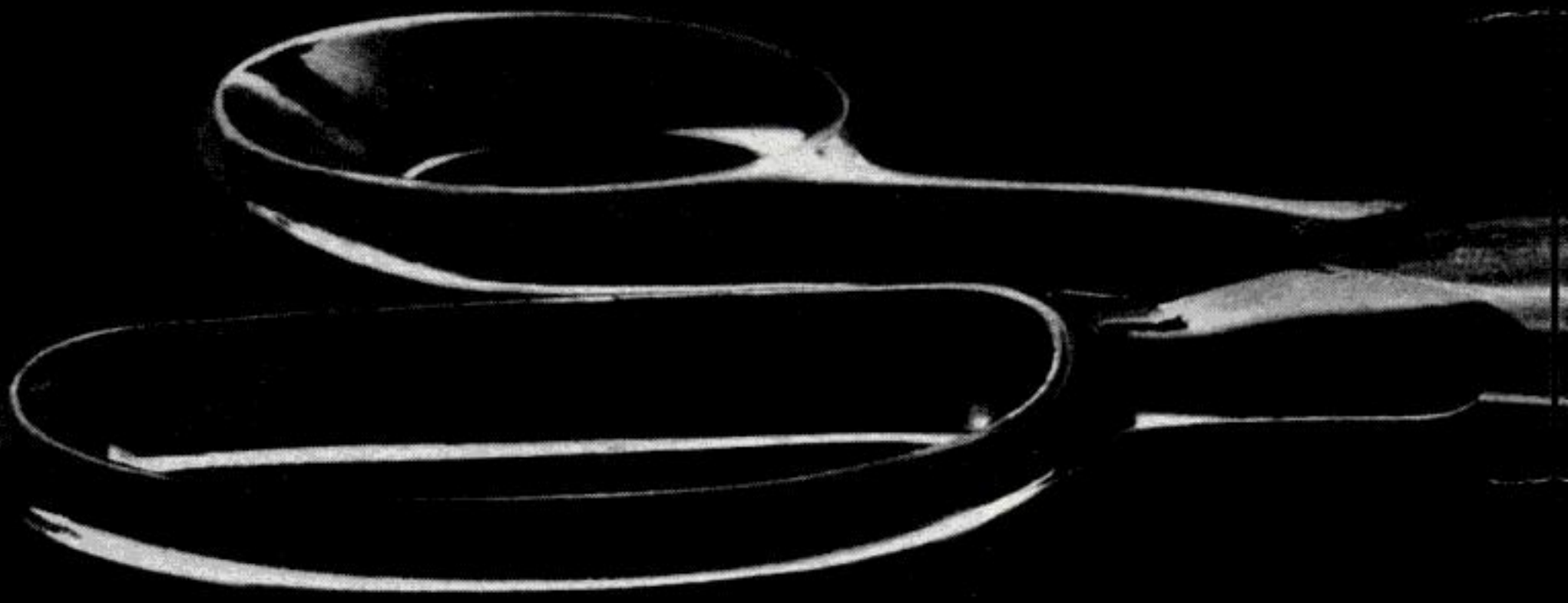

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• Circle No. 11 on the coupon.

Drill Operator Foundry Practice
Industrial Metallurgy
Lathe Operator
Machine Shop Inspection
Machine Shop Practice
Machine Shop Practice & Toolmaking
Metallurgical Engineering Technology
Milling Machine Operator
Patternmaking
Practical Millwrighting
Reading Shop Prints
Rigging Tool Grinder
Toolmaking Turret Lathe Operator
Welding Engineering Technology
Welding Processes

MANUFACTURING ENGINEER
Plan production. Supervise plant layouts, including automated equipment. Earnings range from $5000/yr. to $10,000/yr.

• Circle No. 12 on the coupon.

Industrial Engineering
Industrial Instrumentation
Machine Design
Mechanical Engineering
Quality Control
Safety Engineering Technology
Tool Design Value Analysis

PETROLEUM TECHNOLOGIST
Hold an important position in a stable industry. There's also a future in refinery management and operations. Earnings range from $4000/yr. to $7000/yr.

• Circle No. 13 on the coupon.

Natural Gas Prod. & Transmission
Oil Field Technology
Petroleum Production
Petroleum Refinery Operator
Pipeline Engineering

MATHEMATICIAN
Join the growing ranks of computer programmers, or progress to other specialized scientific activities. Earnings range from $5000/yr. to $13,000/yr.

• Circle No. 14 on the coupon.

Advanced Mathematics
Mathematics and Mechanics for Engineering
Mathematics and Physics for Technicians
Mathematics and Physics for Engineering
Modern Elementary Statistics

PLUMBER
Be a member of this always-ready, steady-employment building trade. Earnings range from $6000/yr. to $10,000/yr.

• Circle No. 15 on the coupon.

Air Conditioning
Air Conditioning Maintenance
Domestic Heating with Oil & Gas
Domestic Refrigeration Heating
Heating & Air Conditioning with Drawing
Plumbing Plumbing & Heating
Plumbing & Heating Contractor
Practical Plumbing Refrigeration
Refrigeration & Air Conditioning
Steam Fitting

PROFESSIONAL ENGINEER
After meeting the requirements of the laws in your state, earn a license with accompanying status and authority. Earnings range from $5000/yr. to $10,000/yr.

• Circle No. 16 on the coupon.

Chemical Civil
Electrical Mechanical

SALESMAN
Meet new people every day. Establish long-term buying contracts. Many companies select top management from the sales force. Earnings range from $5000/yr. to $10,000/yr.

• Circle No. 17 on the coupon.

Creative Salesmanship
Real Estate Salesmanship
Sales Management Salesmanship
Salesmanship & Sales Management

SECRETARY
Be a key staff member of the administrative team. Both men and women fill this vital role today. Earnings range from $4000/yr. to $6000/yr.

• Circle No. 18 on the coupon.

Clerk-Typist Commercial
Legal Secretary Medical Secretary
Professional Secretary Shorthand
Stenographic Typewriting

STEAM AND DIESEL TECHNICIAN
Operate industrial power plants. Chances often open for Chief Engineer. Earnings range from $4000/yr. to $7000/yr.

• Circle No. 19 on the coupon.

Boiler Inspector
Industrial Building Engineer
Power Plant Engineering
Stationary Diesel Engines
Stationary Fireman
Stationary Steam Engineering

SUPERVISOR
Step up to leadership. Use your skills to get results through the management of others. Earnings range from $8000/yr. to $10,000/yr.

• Circle No. 20 on the coupon.

Basic Supervision
Industrial Foremanship
Industrial Supervision
Personality Development
Personnel-Labor Relations
Supervision

TEXTILE TECHNOLOGIST
Important mill management jobs require knowledge of textile techniques, best learned at this level. Earnings range from $4000/yr. to $7000/yr.

• Circle No. 21 on the coupon.

Carding
Carding and Spinning
Cotton Manufacturing
Dyeing & Finishing
Loom Fixing Spinning
Textile Designing
Textile Mill Supervisor
Textile Technology
Warping and Weaving
Wool Manufacturing

TRAFFIC MANAGER
Plan and supervise the movement of products by rail, motor, or air. Earnings range from $5000/yr. to $10,000/yr.

• Circle No. 22 on the coupon.

Motor Traffic Management
Traffic Management

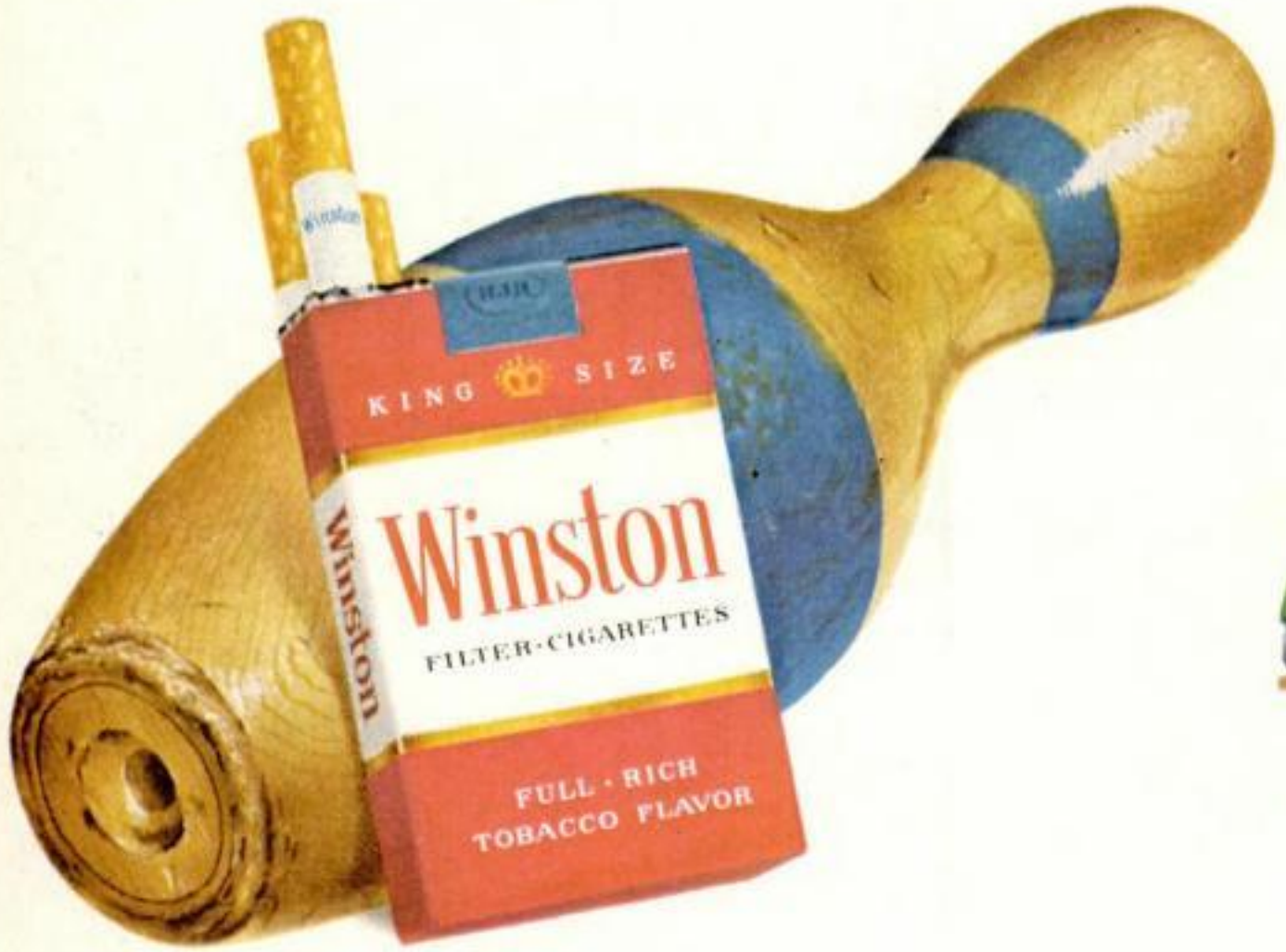
WRITER
Harness your word power. Write newspaper stories, advertising copy, or free lance. Land a position in public relations. Earnings range from $4500/yr. to $10,000/yr.

• Circle No. 23 on the coupon.

Better Business Writing
Free-Lance & Specialty Writing
Introductory Technical Writing
Modern Letter Writing
Practical English
Short Story Writing

Urheberrechtlich geschütztes Material

Flavor that goes with fun...



Up front, Winston packs Filter-Blend: tobaccos specially selected for the best taste in filter smoking. Change to America's best-selling, best-tasting filter cigarette, by far . . . Winston!

Winston tastes good... like a cigarette should!

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